MODULE OUTLINE

1. GENERAL INFORMATION

SCHOOL	SCHOOL OF SCIENCE AND TECHNOLOGY		
PROGRAM COURSE	ADVANCED STUDIES IN PHYSICS		
LEVEL OF STUDY	GRADUATE		
MODULE CODE	PSF62	**YEAR OF STUDY**	2nd
MODULE TITLE	MATERIALS AND DEVICES SCIENCE		
INDEPENDENT TEACHING ACTIVITIES *in case credits are awarded for separate components/parts of the course, e.g. in lectures, laboratory exercises, etc. If credits are awarded for the entire course, give the weekly teaching hours and the total credits*		**HOURS**	**CREDITS**
Weekly teaching hours: 18-19 h x 30 weeks		560	20 ECTS
COURSE TYPE Compulsory, Optional, Optional mandatory	Elective		
PREREQUISITE MODULES:	None		
LANGUAGE OF INSTRUCTION AND EXAMS	GREEK		
THE MODULE IS OFFERED TO ERASMUS STUDENTS	No (due to annual duration of the module)		
MODULE WEBSITE (URL)	https://www.eap.gr/education/postgraduate/annual/advanced-studies-in-physics/topics/#p62 Each module has its own space in the Learning Management System of EAP (http://study.eap.gr), with controlled access (use of code) for students and teaching staff.		

2. LEARNING OUTCOMES

Learning Outcomes

- *The course learning outcomes, specific knowledge, skills and competences of an appropriate (certain) level, which students will acquire upon successful completion of the course, are described in detail. It is necessary to consult:*

PSF62 generally aims to provide in-depth knowledge to students of the postgraduate program "Advanced Studies in Physics" regarding both the Physics of various categories of Materials, and the Physics of Optoelectronics and Photonic Devices in addition to Microelectronic Devices used in modern applications whose function depends on the properties of the aforementioned Materials.

The T.U. aims to provide general and specialized knowledge in the field of Materials and Devices Science. The knowledge focuses a) on the understanding of the behavior of electrons within solid materials and how this behavior categorizes said materials into metals, semiconductors, and insulators, b) the study of the basic manufacturing and

characterization processes and fundamental physico-chemical properties of different classes of materials such as Metals, Semiconductors, Polymers, Magnetic and Ceramic Materials, and c) their applications in various categories of Photonic and Optoelectronic Structures and Devices as well as Microelectronics Devices, such as p-n contacts, electronic diodes, light-emitting diodes and photodiodes/photodetectors, bipolar contact and field effect transistors, solar cells, lasers, and (micro)sensors, in order to analyze in detail their principles of function.

A primary objective of the T.U. is for students to understand the most important optoelectronic and structural properties of the materials in the syllabus and the basic physical and functional principles of the aforementioned devices.

Upon successful completion of PSF62, postgraduate students are expected to possess in-depth knowledge of the properties of these categories of Materials as well as the Physics and functional principles that govern their modern applications in Structures and Devices, mainly in the field of Optoelectronics/Photonics and Energy.

General Competences

Taking into consideration the general competences that students/graduates must acquire (as those are described in the Diploma Supplement and are mentioned below), at which of the following does the course attendance aim?

Search for, analysis and synthesis of data and information by the use of appropriate technologies,
Adapting to new situations
Decision-making
Individual/Independent work
Group/Team work
Working in an international environment
Working in an interdisciplinary environment
Introduction of innovative research
Project planning and management
Respect for diversity and multiculturalism
Environmental awareness
Social, professional and ethical responsibility and sensitivity to gender issues
Critical thinking
Development of free, creative and inductive thinking
……
(Other…….citizenship, spiritual freedom, social awareness, altruism etc.) …….

Search for, analysis and synthesis of data and information by the use of appropriate technologies
Adapting to new situations
Individual/Independent work
Working in an international environment
Working in an interdisciplinary environment
Critical thinking
Development of free, creative and inductive thinking

3. MODULE CONTENT

PSF62 aims to discuss and acquaint students with the fundamental electric, optical, structural, and electronic properties of various classes of Advanced Materials, in addition to the basic physical principles that govern and determine the functionality of various

Optoelectronic and Photonic Devices as well as Microelectronics Devices used in modern applications based on the properties of these materials. The unit also aims to teach students the strong correlation between the properties of materials and the function and characteristics of devices. Categories of materials covered in the syllabus are Metals, Semiconductors, Polymers, Magnetic Materials, and Superconductors, and the devices in which these materials are used with applications in power and light generation and electronic applications are p-n contacts, electronic diodes, light-emitting diodes and photodiodes/photodetectors, bipolar contact and field effect transistors, solar cells, lasers, and (micro)sensors.

The key subjects of the module are:

- Metals – Semiconductors
- Microelectronics
- Sensors and Biosensors
- Laser Beams – Optoelectronics
- Materials Science
- Polymer Science

4. TEACHING METHODS--ASSESSMENT

<table>
<tr><td>MODES OF DELIVERY
Face-to-face, in-class lecturing, distance teaching and distance learning etc.</td><td>Distance learning by conducting six (6) Group Counseling Meetings on weekends during the academic year.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY
Use of ICT in teaching, Laboratory Education, Communication with students</td><td>In the meeting and/or in the homework's the following are used:
- remote meeting tools (cisco Webex, Zoom),
- presentation software (powerpoint type),
- graphic digitizers
- bibliographic databases (Scopus, Web-of-Science)
- mathematical software (Microcal Origin type)

In addition, students use office automation tools, web browsers as well as e-readers for digital books.</td></tr>
<tr><td>MODULE DESIGN
Description of teaching techniques, practices and methods: Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, Internship, Art Workshop, Interactive teaching, Educational visits, projects, Essay writing, Artistic creativity, etc</td><td>
<table>
<tr><th>Activity</th><th>Annual Workload</th></tr>
<tr><td>6 meetings (x 4 hours)</td><td>24</td></tr>
<tr><td>Assignments (6 assignments x 20 hours)</td><td>168</td></tr>
<tr><td>Exams</td><td>3</td></tr>
<tr><td>Individual study</td><td>365</td></tr>
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The study hours for each learning activity as well as the hours of selfdirected study are given following the principles of the ECTS.	**Total module workload (hours)**	**560**
STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS *Detailed description of the evaluation procedures.* *Language of evaluation, assessment methods, formative or summative (conclusive), multiple choice tests, short- answer questions, open-ended questions, problem solving, written work, essay/report, oral exam, presentation, laboratory work, other……etc.* *Specifically defined evaluation criteria are stated, as well as if and where they are accessible by the students*	The exam language is Greek. Written assignments during the academic year, the average of the grades of which participates in the formation of the final grade of the module by 30% if there is a pass in the final or repeat exams. Final written exams, the grade of which participates in forming the final grade of the module by 70%. The written exams include multiple choice questions and detailed problem solving. All criteria are posted, both for each written assignment (in the study) as well as for the general regulation in: https://www.eap.gr/education/study-regulations/	

(5) SUGGESTED BIBLIOGRAPHY

- *Suggested bibliography:*

HOU Publications:

Volume A': From atoms to solids: Metals – Semiconductors, E.N. Economou, HOU, Patras, 2000
Volume B': Microelectronics, G. Kamarinos, HOU, Patras, 2004
Volume C': Sensors and Biosensors, D. Tsoukalas, HOU, Patras, 2003
Volume D': Laser Beams – Optoelectronics, S. Couris, HOU, Patras, 2005
Volume E1': Materials Science-Ceramic Materials, C. Agrafiotis, HOU, Patras, 2003
Volume E2': Materials Science – Magnetic Materials, D. Niarchos, HOU, Patras, 2003
Volume F': Polymer Science, M. Cosmas, HOU, Patras, 2003

Alternative teaching material: Powepoint presentations that include introduction to each individual volume of study, fundamental knowledge, and solved problems (Created by P. Patsalas, provided via Zoom).