COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	PHYSICS DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**211**	**SEMESTER**	**6,8**
COURSE TITLE	MATERIALS SCIENCE		

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*	specialized general knowledge
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://ecourse.uoi.gr/course/view.php?id=3980

(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 aim of this course is to provide students with interdisciplinary knowledge of Materials Science, which combines the principles of Physics and Chemistry. The course covers the fundamental and specialized knowledge of the relationship between the structure and physical properties of materials.

Upon successful completion of the course, students will be able to:

- Understand the periodicity, crystalline structures of solids, and their properties. They will also be able to distinguish between crystalline and amorphous solids, polycrystalline materials, and single crystals.
- Comprehend the relationships between the structure, macroscopic properties, and behavior of materials to solve problems or explain phenomena.
- Possess specialized knowledge about advanced materials and nanomaterials.
- Understand the basic methods of material characterization and interpret the results of corresponding measurements on a quantitative and qualitative level.

- Understand the basic electrical properties of solids related to crystalline structure and energy bands.
- Understand the fundamental principles of magnetism and have the ability to classify magnetic materials.

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.
Working independently.
Working in an interdisciplinary environment.
Production of new research ideas.
Production of free, creative and inductive thinking.

(3) SYLLABUS

Atomic and electronic structure of solids, interatomic bonding in solids. Periodicity and crystal structure. Imperfections and diffusion in solids. Phase diagrams and principles of solidification. Ceramics and glasses. Polymers, definitions, and basic characteristics, configurations of polymer chains. Composite materials. Electrical conductivity of solids, temperature dependence of electrical resistance, Hall effects. Magnetism of matter and classification of magnetic materials. Topological quantum magnetic materials and spintronics. Advanced materials and nanomaterials. Basic techniques for material synthesis and characterization.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face teaching
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	The lectures are supported by the PowerPoint presentation program, using a computer and projector. Additional usage of the ecourse asynchronous e-learning system for uploading notes, homework exercises and essays, and communication with 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.

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

Activity	*Semester workload*
Lectures	39
Tutorials/Practice	13
Educational visits	6
Study and analysis of bibliography	32
Essay writing	6
Non-directed study	26
Exams	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.*	The students' evaluation is done alternatively in two ways: 1. Written final exam (100%). 2. Written final exam (70%) and assignment (30%). • The written final exam includes multiple-choice questions, short answer questions, and problem-solving. • The assignment consists of a written work of up to 1500 words on a specific topic related to materials science, with a mandatory public presentation in class.	

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Materials Science and Engineering: An Introduction, 10th Edition, William D. Callister, Jr. & David G. Rethwisch, John Wiley and Sons, 2019.
- Materials Engineering: Bonding, Structure, and Structure-Property Relationships, 1st Edition, Trolier-McKinstry Susan, Newnham Robert E. Cambridge University Press, 2017.
- The Science and Engineering of Materials, 7th Edition, Donald R. Askeland, Pradeep P. Fulay, Wendelin J. Wright, Cengage Learning, 2021.
- Principles of Electronic Materials and Devices, 4th Edition, Kasap Safa O., McGraw Hill, 2017.