ETE601 - Electrical, Magnetic and Optical Properties of Materials

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETE601	**SEMESTER**	3
COURSE TITLE	Electrical, Magnetic and Optical Properties of Materials		

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	4	4
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	Specialized
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=2392

(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 students learn to calculate the values of physical quantities related to the electrical, optical and magnetic characterization of materials and to evaluate and classify materials as suitable for different applications depending on their properties. **They understand the basic physical principles** that govern the various physical phenomena so that they can design and optimize relevant device applications.
They study the transmission of electromagnetic radiation in solids. They understand the relationships between microstructure and macroscopic properties and material behavior to solve/explain problems/phenomena with the ultimate goal of being able to choose the right materials for specific applications and focus on ways to intervene in materials to properly modify their behavior (for example doping semiconductors with donors and/or acceptors)

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…* *…….*

- Working independently
- Production of new research ideas
- Analysis and synthesis of data and information, with the use of the necessary technology in order to resolve problems
- Production of free, creative and inductive thinking

(3) SYLLABUS

The course content focuses on the following sections:
Electrical Conduction in Solids: Classical Theory- Drude Model. Temperature Dependence of Resistivity.
Matthiessen and Nordheim's Rules. Hall Effect and Devices. Electrical Conductivity of Nonmetals. Intrinsic – Extrinsic Semiconductors. Carrier Concentration Temperature Dependence. Dielectric Materials and Insulation. Polarization Mechanisms and Frequency Dependence. Gauss's Law and Boundary Conditions. Dielectric Strength. Piezoelectricity, Ferroelectricity, Pyroelectricity and applications.

Magnetization of Matter and Magnetic Material Classifications. Saturation Magnetization. Magnetic Domains: Ferromagnetic Materials, hysteresis curve and applications relevant to magnetic properties. Demagnetizing field and magnetostatic analysis of magnetic systems according to magnetic circuits theory.

Optical Properties: Light Waves in a Homogeneous Medium, Refractive Index and Dispersion. Group Velocity and Group Index, Snell' s Law and Total Internal Reflection. Amplitude Reflection and Transmission Coefficients. Complex Refractive Index and Light Absorption (Lattice and Band-To-Band Absorption)

(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 ICT in teaching lectures and tutorials, use of the asynchronous learning system e-course
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	13
Non-directed study, preparation and final examination	48

	Course total	100
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.*	LANGUAGE OF EVALUATION: Greek METHOD OF EVALUATION: Written Final examination	

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

- Kasap Safa O., Principles of electronic materials and Devices, 4th Edition translated in Greek, ISBN: 978-960-418-556-6, 2018, Editions Tziola
- William D. Callister, Jr., David G. Rethwitch, Materials Science and Engineering, 9th Edition translated in Greek, ISBN: 978-960-8050-90-1, Editions Tziola
- In Greek: Φυσική Στερεάς Κατάστασης, Τόμος Ι : Μέταλλα, Ημιαγωγοί, Μονωτές, Ε. Ν. ΟΙΚΟΝΟΜΟΥ, Πανεπιστημιακές Εκδόσεις Κρήτης, Ηράκλειο 1997, ISBN SET 960-524-038-6