ETY803 - Magnetic Materials-Superconductors

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETY803	**SEMESTER**	8
COURSE TITLE	Magnetic Materials - Superconductors		

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 / Tutorials	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*	Special background
PREREQUISITE COURSES:	Calculus, Basic principles of Quantum Mechanics and Solid State Physics.
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=737

(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*

Introduction of students to basic concepts related to science and engineering of magnetic and superconducting materials as well as their applications. The
students acquire advanced knowledge and skills related to research, development, testing and evaluation of the various types of magnetic materials which are now indispensable part of our everyday life due to their various applications that range from heavy industrial applications (such as motors, generators, transformers) as well as edge technological applications (magnetic memories, recording discs, heads, micro-sensors). They can prepare research studies and make scientific decisions related to the design, development, production, processing, quality control / certification of material related products.

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
Decision-making
Working independently
Team work
Working in an interdisciplinary environment

(3) SYLLABUS

Magnetic Dipole moment orbital and spin contributions. Paramagnetism. Exchange interactions and types of Magnetic Order. Mean Field Approximation. Band paramagnetism and Ferromagnetism (Stoner Criterion). Slater-Pauling Curve. Magnetic Anisotropy. Magnetic Domains and Walls. Single Domain Particles. Magnetization reversal mechanisms. Hard Magnets. Soft Magnets. Magnetostriction. Magneto-optical effects. Magnetoresistance. The Superconducting state. Meissner effect. Critical Current. Intermediate State. Electrodynamics of Superconductors-London Equations- penetration depth. BCS Theory. Correlation Length. Quantum phenomena in Superconductors. Type-II superconductors. Mixed State. Superconducting Materials and Applications. High temperature superconductors.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class, lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, 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,*	

Activity	*Semester workload*
Lectures	39
Tutorials	13
Self-study	48

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*		
	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: Final written examination	

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

- *"Magnetism and Magnetic Materials" J. M. D. COEY, Cambridge University Press 2009*
- *«Physics of Ferromagnetism», Chikazoumi, 2005, Oxford University Press*
- *«Simple Models of Magnetism» Ralph Skomski, 2006, Oxford University Press*
- *«Superconductivity» Charles P. Poole, Jr.Horacio A. Farach, Richard J. Creswick Ruslan Prozorov, 2007, Elsevier*
- *"Magnetism in Condensed Matter" Stephen Blundell, Publisher: Oxford University Press, USA, 2001*
- *"Modern Magnetic Materials: Principles and Applications", Robert C. O'Handley, 2000 John Wiley and Sons.*

-Related academic journals:

- Journal of Magnetism and Magnetic Materials
- IEEE Transactions on Magnetics
- Journal of Applied Physics
- APL Materials