ETE816 - Magnetic Materials Design

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING			
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING			
LEVEL OF STUDIES	UNDERGRADUATE			
COURSE CODE	ETE816	**SEMESTER**	8	
COURSE TITLE	Magnetic Materials Design			
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			3	3
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, skills development			
PREREQUISITE COURSES:	NO			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO			
COURSE WEBSITE (URL)				

(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*

Following the basic course on magnetic materials the students are introduced to problems related to the optimization magnetic materials under conflicting design requirements and updated to more specialized current research topics, at the forefront of knowledge in this field, with more emphasis to the connection of magnetism to other (transport, optical, mechanical, etc.) properties i.e. towards spintronic and multifunctional applications.
These skills are the basis for original thinking in magnetism and at the interface
with other in other electronic materials and sensor/actuator applications. 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 *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 required technology. Decision-making, Working independently, Team work, Working in an interdisciplinary environment, Production of new research ideas, specialized problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields.

(3) SYLLABUS

Magnetic Circuits. Permanent Magnet systems. Device dependent optimization of permanent magnet materials. Hard-Soft Nanocomposites. Magnetocaloric refrigeration. Magnetic recording media and heads. Conflicting media requirements for ultra high density recording. Magnetoeletcronic Materials, Definition and measurement of spin polarization, Spintronics, Spin valves, Spin Hall effect, Spin Torque oscillators. Magnetization reversal by electric current. Polyferroic tunnel juctions. Magnetoeletric control of the magnetic state. Dynamics, Ballistic Switching, Microwave assisted Magnetization Revesal, Magnonics, Magnetooptical Switching. Interfacial Dzyaloshinskii-Moriya interaction, Skyrmions, topologically stable magnetic structures. Spin Ices.

(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, 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*	

Activity	*Semester workload*
Lectures	39
Self-study	36

the ECTS		
	Course total	***75h***
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, written work, problem assignments.	

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

- "Magnetism and Magnetic Materials" J. M. D. COEY, Cambridge University Press 2009
- "Nanomagnetism and Spintronics" Teruya Shinjov Elsevier 2009
- Permanent Magnet Motor technology, G.F. Gieras, M. Wing, Marcel Dekker inc 2002
- «Simple Models of Magnetism» Ralph Skomski, 2006, Oxford University Press
- "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