ETY405 - Laboratory Materials I (Materials Characterization Techniques)

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETY405	**SEMESTER**	4
COURSE TITLE	Materials Laboratory I (Materials Characterization Techniques)		

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	5	6
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:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	-
COURSE WEBSITE (URL)	http://msl.uoimaterials.site/

(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*

In Materials Laboratory I, goal is to understand the most important techniques used to characterize and study the properties of traditional and advanced materials. Thus, the most basic methods of material characterization are studied in detail, such as X-ray absorption techniques, X-ray fluorescence spectroscopy, X-ray diffraction, thermal analysis measurements, vibratory hardness spectroscopy techniques as well as basic measurements of mechanical properties. An in-depth understanding of these techniques, the preparation of measurement samples, the performance of measurements as well as the analysis of measurements are the main goal and integral part of laboratory training. These exercises are timeless, internationally and widely accepted and well-known and are taught in the fourth semester of study in the Departments of Chemical Engineering.

Upon successful completion of the course the student will be able to:

distinguish, explain, evaluate and conclude the value and importance of the above knowledge

from each Laboratory Exercise as a necessary condition for learning the laboratory techniques which ultimately aims at the knowledge of the mechanical properties of materials, in the revelation of the microstructure, in the chemical composition but also in their morphology, in the shaping and in the characterization of the final product. Regarding the Application, the student must (ie must be able) be able to use this knowledge beyond the narrow confines of this course, and specifically in the context of the challenges he will face in practicing the profession of Materials Engineer, in industry or research. Finally, the course of the Materials Laboratory I, but each laboratory or theoretical course must show the student the direction, the student must find the way.

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, analyze and compose data and information, using the necessary technologies
• Teamwork
• Promoting free, creative and inductive thinking
• Adaptation to new situations

(3) SYLLABUS

The Materials Laboratory I is a 4th semester course, compulsory, with a five-hour weekly program, two hours of teaching and three hours of laboratory. The workshop includes ten selected exercises whose content is summarized in the following titles:

- *Electronic spectrum measurements with UV-vis spectroscopy*
- *Infrared spectroscopy (study of structural and visual properties of ceramic and polymeric materials)*
- *Material hardness measurement methods*
- *Thermal material analysis study (DSC technique)*
- *Measuring strength of materials (tension - grief - bending).*
- *Metallurgical preparation of essays*
- *Microscopic observation of microstructure*
- *X-ray interaction with matter*
- *X-ray spectroscopy*
- *X-ray refraction*

(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*	Specialized programs for processing spectroscopic experimental data (UV-Vis, IR, etc.), X-rays, taking microstructural images from microscopic observation of specimens, analysis of thermal diagrams and tensile diagrams.
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,*	

Activity	***Semester workload***
Lectures	26
Laboratory practice	39
The student's study hours	65

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*		
		20
	Course total	150
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: (i) Written work for each laboratory exercise (ii) Oral examination in the laboratory (iii) Written examination at the end of the semester Written	

(5) ATTACHED BIBLIOGRAPHY

- -*Suggested bibliography:*

- Laboratory Exercises Handbook, University of Ioannina. The students of the Department have at their disposal the book of Materials laboratories I, "Techniques for Characterization of Materials" which is distributed at the beginning of the semester. The book is a comprehensive series of exercises related to material characterization techniques in the light of the science of materials with many references to experimental details and can be used to teach undergraduate and graduate students.
- V.A. Phillips, Modern Metallographic Techniques and Their Applications, Inter-science, 1971.
- G.F. Vander Voort, Metallography: Principles and Practice, McGraw-Hill, 1984.
- G. D. Chrysoulakis, D. I. Pantelis, Science and Technology of Metal Materials, Papasotiriou Publications, Athens, 1996.
- G. Elssner, H. Hoven, G. Kiessler and P. Wellner, Ceramics and Ceramic Composites: Materialographic Preparation, Elsevier, 1999.
- G. F. Vander Voort, Metallography, Principle and practice, ASM International, Ohio, USA, 2nd ed.