ETY505 - Laboratory of Materials II (Ceramics and Composite Materials)

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETY505	**SEMESTER**	6
COURSE TITLE	Laboratory of Materials II (Ceramics and Composite 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**
Laboratory exercises, 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	Yes
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*

- **Learning outcomes:**

In this Laboratory the aim is to learn the methods of laboratory preparation and characterization of ceramic materials, glass, glass-ceramic and composite ceramic materials. The methods taught in the Laboratory are used internationally and widely both on a laboratory and industrial scale. The learning of laboratory techniques focuses at the raw materials, in terms of their chemical composition but also their morphology, in shaping, in the manufacturing processes, in the characterization of the final product but also in the materials in the intermediate stages of preparation.

- **Skills** (ie problem solving, transferring existing knowledge and acquired skills to new situations):

The Laboratory has been placed in the Curriculum in the 6th semester. The students have been taught in the 5th semester the Ceramic Materials and the course of Metallurgy and thus they are

prepared, in terms of the necessary theoretical background, so that they can attend the Exercises in this Lab. Also, the Laboratory helps in the understanding of the elective course in the next (7th) semester that specializes in the Technology of Ceramic Materials and Glasses. Consequently, the students (in the perspective of their professional rehabilitation as Materials Engineers), after their successful training in this Laboratory, are fully capable of working in any laboratory or ceramic industry in the world and facing all possible technical and technological challenges that may arise both in the research laboratory and in industry, either in the ceramic production line, or in quality control. Thus, regarding the ability of *Analysis*, the student must be able (ie, expected to be able) to distinguish the distinct components (ie Exercises) of the knowledge acquired from this laboratory and to fully understand the organizational structure as taught in this course, regarding the ability of *Composition*, the student must be able (that is, expected to be able) to create, compose, organize but also to propose and revise this knowledge, not only per se from the same course, but mainly by using data from other courses in the same year and from previous ones, but also to be excellently prepared to do the same in the following years but also in practical exercises in older years, and regarding the ability in *Assessment*, the student must be able (i.e., expected to be competent) to make evaluative judgments regarding this knowledge, in the sense of comparison, conclusions, judgment, evaluation and support, especially in the practice of his profession, as a Materials Engineer, when it will require the use of this knowledge.

- **Competences** (ie combination of understanding and application):

The laboratory exercises introduce students to the mentality of Materials Engineering both in the most traditional ceramics, which are a cornerstone of a country's industry but also in Europe and internationally, as well as in the most modern appearances and perspectives of ceramic materials, which are particularly attractive for the specific characteristics of Greece, such as nano-technology, composite nano-materials and micro- and nano-dimensional ceramic materials, such as coatings. Thus, regarding the *Understanding*, the student must be able (that is, expected to be able) to distinguish, explain, evaluate and conclude the value and importance of the above knowledge from each Laboratory Exercise as necessary of the Technique of Ceramics as a basic component of the subject of Materials Engineering, and regarding the *Application*, the student is (ie must be) able to use the knowledge both in the strict context of this course, and in the context of the challenges that will practiced in the profession of Materials Engineer, in industry or in research.

The teaching of the course of this Laboratory, with questions and discussion during it as well as with the assignments, in conjunction with the evaluation of the students are done in such a way as to satisfy all the above learning outcomes, one by one and in a completely distinct way, ie exactly what the student is expected to be able to do when he / she successfully completes this course, as well as to know the knowledge that he / she will acquire.

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
- Adapting to new situations
- Decision-making
- Working independently
- Team work

- Production of new research ideas
- Criticism and self-criticism
- Production of free, creative and inductive thinking

(3) SYLLABUS

The course includes laboratory exercises along with theoretical lessons. The course content is concentrated in the following sections:

1. Mesoporous ceramics
2. Intercalation of clays
3. Nano-composites reinforced with nanoceramics
4. Glasses: Production and characterization of their structure
5. Colored glasses
6. Sol-gel processing for producing high purity ceramic raw powders
7. Shaping techniques for producing advanced and traditional ceramics – quality control
8. Ceramic coatings

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face in the Lab and in the classroom
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 the ECTS*	

Activity	***Semester workload***
Laboratory exercises	39
Lectures	26
Homework (analysis of experimental findings)	39
Unattended study for preparing the forthcoming exercise and test that is put to all students before starting each exercise)	26
Unattended study for preparing the students for the final exams	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*	LANGUAGE OF EVALUATION: Greek METHOD OF EVALUATION: 1. Tests (questionnaires) at weekly base (before starting each exercise) 2. Homework (full scientific report with the analysis of the experimental findings) 3. Final exam

to students.	

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

- M. Karakasides, D. Gournis, K. Beltsios, S. Agathopoulos, Notes for the Laboratory Materials II, University Press, University of Ioannina (in Greek).

-Related scientific journals:

This course (Laboratory) contains generic issues. Thus, there are not specific journals on it. However, the following journals, which focus on Ceramics, are surely related with it:

- Journal of the European Ceramic Society
- Journal of the American Ceramic Society
- Ceramics International