ETY603 - Ceramics

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETY603	**SEMESTER**	5
COURSE TITLE	Ceramics		
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		6	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)	chemat.uoi.gr/σύνδεσμοι/διαφάνειες		

(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:**

The aim of this course is to introduce students to ceramic materials, glass, glass-ceramic materials and binders, in terms of both science and engineering. The teaching of the science of ceramic materials aims at learning the properties of these materials, such as physical, chemical, electrical, optical, magnetic, as a result of their compositions. The teaching of ceramic engineering aims to learn all the experimental methods of manufacturing and testing ceramic materials as applied around the world. The interest of the course is focused on all categories of ceramic materials, and in terms of composition, e.g. oxides, carbides, nitrides, glass, binders (cement and gypsum), and in their form, e.g. powders, porous and solid materials, from macro- to micro- and nano-dimensions, and in terms of their final application, ie advanced ceramics, such as nano-tech ceramics, nano-composites and nano-dimensions, such as coatings.

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

The course has been placed in the Curriculum in the 5th semester. Thus, after its teaching and successful attendance, the students are absolutely, in terms of the necessary theoretical background, capable and prepared to be able to attend the Labs in Ceramic Materials in the relevant Laboratory that follows in the next (6th) semester. Also, together with the aforementioned Laboratory, this course is the necessary scientific background for the understanding of the elective course in the 7th semester that specializes in Technology of Ceramic Materials, Glass and Glass-Ceramic Materials. Consequently, students (in the perspective of their professional rehabilitation as Materials Engineers), after successfully attending this course, in combination with their successful practice in the Laboratory of the next semester, are fully capable of working in any laboratory or the international ceramics industry and to face all the possible technical and technological challenges that may arise both in the research laboratory and in the industry, either in the ceramics production line or in the quality control. Thus, regarding the ability of *Analysis*, the student must be able (that is, expected to be able) to distinguish the distinct components of the knowledge acquired from this course and to fully understand their organizational structure as taught in the course. In relation to the ability of *Synthesis*, 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 the knowledge itself course, but mainly with the use of data from other courses in the same year and from previous ones, but also to be excellently prepared to do the same in subsequent years but also in internships in next years, and regarding the ability in *Assessment*, the student must be able (ie expected to be able to) make evaluative judgments about this knowledge, in the sense of comparison, drawing conclusions, their evaluation and support, especially in the practice of his profession, as a Materials Engineer, when this will require the use of this knowledge.

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

The above are absolutely necessary (in terms of skills) for the Materials Engineer to design new ceramic material compositions with the desired properties as well as in the quality control of ceramic materials produced by the industry and marketed and applied in a number of applications, on the other hand are a particularly attractive perspective (and acquired skill) for the graduates of the Department as they match the particular characteristics of the Greek Economy, such as traditional ceramics, which is a cornerstone of a country's industry but also of Europe and internationally, but also advanced ceramics, which should be the future of the country's development in the near future. Thus, with regard to *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 as necessary to the Science and Technique of Ceramics as a key component of the Materials Engineering subject, and with regard to *Application*, the student is (that is, must be) able to use the knowledge both in the strict context of this course and in the context of the challenges he will face in practicing the profession of Materials Engineer, in industry or research.

The teaching of the course with questions and discussion during it as well as with the assignments (as a kind of project) as well as 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 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…*
	…….

- Working independently
- Team work

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

(3) SYLLABUS

1. Ceramics in Industry and in Materials Science
2. Raw materials
3. Categories of ceramics
4. Processing – shaping techniques
5. Coatings
6. Crystalline structures
7. Non-crystalline solids (glasses)
8. Phase diagrams
9. Nucleation – crystal growth – devitrification and solid state reactions
10. Non-equilibrium regimes
11. Microstructure
12. Mechanical properties
13. Thermal properties
14. Optical properties
15. Electrical properties
16. Chemical properties

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face in the classroom
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Yes
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	52
Exercises in the classroom	26
Assignment of a project	39
Unattended study of students for their examination preparation	33
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: Final exams The assignments (which are optional) are also evaluated by 40% (and the rest 60% is the score of the final exams)

to students.	

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

- M. Karakasidis, University Notes, University Press, Ioannina (in Greek).
- Ch. P. Ftikos, Ceramics Science and Engineering , 960-254-648-4 (ISBN 25887), University press of the NTUA (in Greek)

-Related scientific journals:

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