ETY912 - Material Characterization Techniques

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETY912	**SEMESTER**	9
COURSE TITLE	Material 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 and laboratory exercises	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 general knowledge
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	-
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:**

The aim of this course is to introduce students to the basic principles of the main characterization techniques used nowadays to study the structure and the properties of materials, namely in Raman microspectroscopy, thermal analysis (TGA-DTA), porosimetry measurements (N_2 , Hg), in X-ray powder diffraction (PXRD), in Auger spectroscopy and X-ray fluorescence (XRF), in electron microscopy SEM and TEM. The course includes laboratory, where students are trained in small groups in the use of these techniques using the research equipment of the Department or the network of horizontal laboratories of the University.

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

Upon completion of this course, students are able to use the results of the measurements, analyzing the selected results set by the teacher of each exercise. Also, under the prospect of their professional rehabilitation as Materials Engineers, after successfully attending this course, in conjunction with their successful practice in the Laboratory, the students are fully capable of working in any laboratory or industry in the world and facing all possible technical challenges, which can be presented both in the research laboratory and in industry, or in the material production line, or in 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 (ie of each characterization techniques) acquired from this course and to fully understand the organizational structure as they were 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 from the same course itself, but mainly by using data from other courses in the same year and from previous ones, but also to be fully capable and excellently prepared to do the same in practical exercises and in the Diploma Thesis, and with regard to the ability in *Assessment*, the student must be able (i.e., expected to be able) to make evaluative judgments regarding this knowledge, drawing conclusions, judging, evaluating and supporting them, 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 above, ie the understanding of the potential of each technique and the processing and extraction of the demanded information, are absolutely necessary (in terms of skills) for a Materials Engineer and are a very attractive perspective (and acquired skill) for the graduates of the Department. Thus, with regard to *Understanding*, the student must be able (i.e., expected to be able) to distinguish, explain, evaluate and conclude the value and the importance of the above knowledge as essential to Materials Engineering, and with respect to with the *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 in research.

The teaching of the course, with questions and discussion, as well as with the laboratory exercises, 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 also in a completely distinct way, ie what exactly the student is expected to be able to do when he / she successfully completes this course, and also 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…*
	…….

- Working independently
- Team work
- Production of new research ideas
- Production of free, creative and inductive thinking

(3) SYLLABUS

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

1. μ-Raman spectroscopy
2. Thermal analysis (DGA, DTA)

3. Porosimetry (N_2, Hg) 4. Diffraction of X-ray powder analysis – powder (PXRD) 5. Auger spectroscopy and XRF 6. SEM 7. TEM

(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*	-
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*	see table below
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: Projects and a Full Scientific Report (Essay) on a scientific topic or Final Exams.

Activity	***Semester workload***
Lectures	21
Laboratory exercises	21
Home work (projects with small exercises and literature survey)	15
Unattended study of the student for the preparation for the final exams or writing of an essay-report	18
Course total	75

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

Books:

- Notes and handbooks of the professors who teach the course (D. Anagnostopoulos, M. Karakasidis, A, Avgeropoulos, A. Karantzalis), University Press, University of Ioannina, (in Greek)

-Related scientific journals:

- Journal of Molecular Spectroscopy
- Vibrational Spectroscopy
- X-Ray Spectrometry
- Journal of Thermal Analysis and Calorimetry
- Journal of Porous Materials
- Journal of Microscopy