ETY917 - Laboratory of Materials V (Polymers)

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETY917	**SEMESTER**	**8**
COURSE TITLE	Laboratory of Materials V (Polymers)		

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 / Tutorials	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*	General background
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	-
COURSE WEBSITE (URL)	http://www.materials.uoi.gr/en/0.02.01.html

(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*

This mandatory laboratory is the first contact of undergraduate students with Polymers at the laboratory level to fully understand the ways of synthesis, characterization, applications of polymers and recognition of polymers-plastics of daily use with simple methods. It takes place in the 8th semester, one semester after the teaching of the compulsory theoretical course "Polymer Science".

In this laboratory course the practical understanding of experiments taught in the course: “Polymer Science” in the 7th semester and in the course: “Polymer Engineering” in the 8th semester takes place.

Upon successful completion of the course the student is able to:

- Confirm the correct perception of what has been taught in Polymer Science and Engineering courses, solve questions and address concerns that may have arisen during the teaching and the course of the laboratory exercises.
- Understand how polymers are prepared and comprehend the possible problems that arise when they are synthesized

- Understand and realize the reasons why specific polymerization techniques are used in the Plastic, Color, Packaging Materials, etc. Industry.
- Understand what techniques can be used to characterize the polymers, as well as the advantages and limitations of these techniques
- Come in contact with basic and widely used plastics, and understand how he/she can identify them with simple methods such as combustion, visual inspection, density and solubility.

There is no course material overlap with other laboratory courses taught at the Department of Materials Science Engineering Undergraduate Course Curriculum.
To a very limited extent some exercises have been made (only 2) in other laboratories (e.g. preparation of Nylon 6.10 and mechanical properties on other materials) but without any emphasis on chemistry, reactions, kinetic and mechanical properties of polymers.
With this mandatory laboratory course, the undergraduate students are introduced to the premises of the Polymer Science & Engineering Laboratory in order if any of them wishes to start his/her diploma thesis in the specific laboratory from the next semester.
Also, the teaching aids are updated with a detailed overview of all the new aids that have been issued or are going to be issued in the direction of Polymer Science with emphasis on Polymer Chemistry. When a more modernized book emerges that covers the material of the lectures-lectures, it is given as an option by the online system EVDOXOS.
The purpose of the teaching aids is to cover all the material taught and they are provided to the students in order for them to better understand and deal with problems and questions which might be raised during the laboratory hours.

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…*
	…….

1) Adapting to new situations
2) Decision-making
3) Working independently
4) Team work
5) Working in an interdisciplinary environment
6) Production of free, creative and inductive thinking
7) Production of new research ideas

(3) SYLLABUS

Laboratory Exercises:

1. Synthesis of Nylon 6,10 by step-wise interfacial polymerization and determination of melting point (T_m) of an unknown polymer.
2. Free radical polymerization of methyl methacrylate. Bulk polymerization.
3. Free radical polymerization of styrene in solution.
4. Anionic polymerization of styrene.
5. Determination of average molecular weights and polydispersity index with Size Exclusion

Chromatography (M_n, M_w, I).

6. Determination of number average molecular weight (M_n) and second Virial coefficient (A_2) with membrane osmometry and vapor pressure osmometry.
7. Viscometry of dilute polymer solutions and determination of [η], M_v and $<S^2>^{1/2}$.
8. Calculation of dynamic viscosity, shear stress and deformation rate with automated viscosity.
9. Chemical oxidative polymerization of aniline.
10. Identification of well-known polymers via simple methods and mechanical properties of polymers.
11. Stress/strain experiments via Instron machine for mechanical properties characterization of polypropylene "dogbones".
12. Dynamic light scattering (DLS) characterization for the determination of hydrodynamic diameter of hydrogel nanoparticles and maghemite nanocrystals

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face teaching, demonstration of the exercises
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of ICT in teaching during the lectures, communicating with students during teaching and while performing the exercises in the laboratory, also communicating with the students during office hours
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	26
Laboratory practice	39
Student Self-study for preparing for analysis of the laboratory data	39
Student self-study for preparing for the next laboratory exercise	26
Student self-study for preparing 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 to students.*	LANGUAGE OF EVALUATION: Greek METHOD OF EVALUATION: No assignments are given since for every laboratory exercise written and oral exams are taken for this compalsory course. (i) Final written examination: 100%

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

- "Laboratory of Materials V (Polymers)" Notes, A. Avgeropoulos, N. Zafeiropoulos, M. Karambela, University of Ioannina, Ioannina, 2018

- Polymer Science & Technology, K. Panayiotou, Pigasos Publishing, Thessaloniki, 2000 (ISBN: 9789603170556)

- Synthesis and Characterization of Polymers: Laboratory Tutorial, G. P. Karayiannidis, E. D. Sideridou, D. S. Achillias, D. N. Bikiaris, Zitis Publishing, Thessaloniki, 2009 (ISBN: 9604315080)