COURSE OUTLINE

(1) GENERAL

SCHOOL	SCIENCES		
ACADEMIC UNIT	DEPT. OF PHYSICS		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**218**	**SEMESTER**	**7**
COURSE TITLE	POLYMER SOLIDS		

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**
	4	4
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	special background, specialised general knowledge, skills development
PREREQUISITE COURSES:	Thermodynamics
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK or ENGLISH
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://ecourse.uoi.gr/enrol/index.php?id=3077

(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*

The course provides the student with the basic knowledge of soft matter science and in particular of polymer science with emphasis on polymer physics. Following the successful completion of the course, students should have acquired basic knowledge and certain abilities/skills as follows:

- Ability to differentiate between polymers and “plastics”; between amorphous and semicrystalline polymers.
- Ability to evaluate the shape and size of a polymer coil by simple calculations
- Combine results from polarizing optical microscopy, differential scanning calorimetry, dielectric spectroscopy and rheology to evaluate the structure and dynamics of semicrystalline and amorphous polymers. Use of Origin or similar package is essential.
- Analyse/evaluate experimental results, prepare an oral presentation based on their findings and present an essay in the class. Being able to answer simple questions on the (dynamic and static) properties of polymers based on their

experimental findings.

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…*
	…….

Lab-on experience on four experimental techniques (polarizing optical microscopy, differential scanning calorimetry, dielectric spectroscopy and rheology).
Search for, analysis and synthesis of data and information, with the use of the necessary technology.
Adapting to new situations
Decision-making
Team work
Criticism and self-criticism
Project planning and management
Production of free, creative and inductive thinking

(3) SYLLABUS

Introduction, “plastics” vs. “polymers”, classification of polymers, polymer conformation, shape and size of macromolecules, glass “transition” and polymer dynamics, semicrystalline polymers, hierarchical levels of organization, crystallization kinetics, dynamics of semicrystalline polymers, liquid-crystalline polymers and their phases. Four lab experiments: (1) Differential scanning calorimetry (glass temperature, crystallization/melting temperature of amorphous/semicrystalline polymers) (3 hours); (2) Polarizing optical microscopy (nucleation and growth, Loritzen-Hofmann theory of crystal growth) (8 hours); (3) Dielectric spectroscopy (characteristic time scales of polymer dynamics as a function of temperature) (12 hours); (4) Rheology (measurements of shear modulus/viscosity as a function of frequency for a range of temperatures, viscoelastic properties of polymers, thermorheological simplicity, time scales of polymer motion) (12 hours).

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face. In addition, lab-on experience on four experimental techniques
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of distance learning (e-course) to post notes, problem sheets and to facilitate communication with the students. Oral Presentation (pptx)
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.*	

Activity	***Semester workload***
Lectures	40
Problem Solving	10
Homework, study, preparation and presentation of the pptx in the class, Written essay	30

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	Lab practice/measurements/analysis of 4 experiments	17
	Exam	3
	Course total	100
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.*	(a) Open class (oral) presentation of an essay that is based on the results/analyses of the four lab experiments (90%) (b) Homework exercise – Written essay (10%)	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

[1] K. Panagiotou, Polymers: Science and Technology. Ed Simonis, Thessaloniki, 2023.
[2] Floudas, G. In Dielectric Spectroscopy. Matyjaszewski, K. and Möller, M. (Eds.) Polymer Science: A Comprehensive Reference, vol. 2.32, pp.825-845. Amsterdam: Elsevier BV, 2012.