

## COURSE OUTLINE

### (1) GENERAL

<b>SCHOOL</b>	NATURAL SCIENCES		
<b>ACADEMIC UNIT</b>	DEPT. OF PHYSICS		
<b>LEVEL OF STUDIES</b>	UNDERGRADUATE		
<b>COURSE CODE</b>	218	<b>SEMESTER</b>	7
<b>COURSE TITLE</b>	POLYMER SOLIDS		
<b>INDEPENDENT TEACHING ACTIVITIES</b> <i>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</i>	<b>WEEKLY TEACHING HOURS</b>	<b>CREDITS</b>	
	5	5	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
<b>COURSE TYPE</b> <i>general background, special background, specialised general knowledge, skills development</i>	special background, specialised general knowledge, skills development		
<b>PREREQUISITE COURSES:</b>	Thermodynamics		
<b>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</b>	GREEK		
<b>IS THE COURSE OFFERED TO ERASMUS STUDENTS</b>	YES		
<b>COURSE WEBSITE (URL)</b>			

### (2) LEARNING OUTCOMES

<p><b>Learning outcomes</b></p> <p><i>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.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> <li>• <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i></li> <li>• <i>Descriptors for Levels 6, 7 &amp; 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i></li> <li>• <i>Guidelines for writing Learning Outcomes</i></li> </ul>
<p>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:</p> <ul style="list-style-type: none"> <li>- Ability to differentiate between polymers and “plastics”; between amorphous and semicrystalline polymers.</li> <li>- Ability to evaluate the shape and size of a polymer coil by simple calculations</li> <li>- Combine results from polarizing optical microscopy, differential scanning calorimetry, dielectric spectroscopy and rheology to evaluate the structure and dynamics of semicrystalline and amorphous polymers.</li> <li>- Analyse/evaluate experimental results, prepare an oral presentation based on their findings and present an essay in the class.</li> <li>- Being able to answer simple questions on the (dynamic and static) properties of polymers based on their experimental findings.</li> </ul>

### 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  
 Adapting to new situations  
 Decision-making  
 Working independently  
 Team work  
 Working in an international environment  
 Working in an interdisciplinary environment  
 Production of new research ideas

Project planning and management  
 Respect for difference and multiculturalism  
 Respect for the natural environment  
 Showing social, professional and ethical responsibility and sensitivity to gender issues  
 Criticism and self-criticism  
 Production of free, creative and inductive thinking  
 .....  
 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); (2) Polarizing optical microscopy (nucleation and growth, Loritzen-Hofmann theory of crystal growth); (3) Dielectric spectroscopy (characteristic time scales of polymer dynamics as a function of temperature); (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).

### (4) TEACHING and LEARNING METHODS - EVALUATION

<b>DELIVERY</b> <i>Face-to-face, Distance learning, etc.</i>	Face-to-face. In addition, lab-on experience on four experimental techniques	
<b>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</b> <i>Use of ICT in teaching, laboratory education, communication with students</i>	Use of distance learning (e-course) to post notes, problem sheets and to facilitate communication with the students. Oral Presentation (pptx)	
<b>TEACHING METHODS</b> <i>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</i>	<b>Activity</b>	<b>Semester workload</b>
	Lectures	40
	Problem Solving	10
	Homework, study, preparation and presentation of the pptx in the class, Written essay	30
	Lab practice/measurements/analysis of 4 experiments	42

	Exam	3
	Course total	125
<p align="center"><b>STUDENT PERFORMANCE EVALUATION</b></p> <p><i>Description of the evaluation procedure</i></p> <p><i>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</i></p> <p><i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></p>	<p>(a) Open class (oral) presentation of an essay that is based on the results/analyses of the four lab experiments (90%)</p> <p>(b) Homework exercise – Written essay (10%)</p>	

#### **(5) ATTACHED BIBLIOGRAPHY**

- *Suggested bibliography:*  
- *Related academic journals:*

- [1] K. Panagiotou, Science and Technology of Polymers  
[2] U.W. Gedde, Polymer Physics  
[3] Kremer, F.; Schöenhals, A. *Eds. Broadband Dielectric Spectroscopy*, Springer: Berlin 2002  
[4] 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.