COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**10EK503**	**SEMESTER**	**7**
COURSE TITLE	**SOFT MATTER PHYSICS**		

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 (theory and exercises)	4	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized Knowledge
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	*https://eclass.uoa.gr/courses/PHYS226/*

(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*

In this course the student acquires the necessary knowledge for the understanding of several physicalquantities related to the soft matter physics.

With the completion of the course the student is able to:

- Recognize and describe soft matter systems.
- Understand the molecular interactions and how these are combined to give rise to complex systems.
- Explain the basic concepts, principles and laws related to the organization and properties of polymers, liquid crystals, colloids, membranes, proteins.
- Acquire the basic theoretical knowledge relevant to some applications of soft matter physics.
- Use knowledge from electrostatic, statistical physics, thermodynamics, mechanics, and mathematical methods of physics for understanding of complex systems in soft matter physics.
- Calculate various physical parameters using theproper mathematical formulas.
- Compose concepts and physical laws that leadto the problem solving of complex physical systems.
- Combine mathematical formulas in complex physics problems.
- Evaluate the results of the physics problems.

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…*
	…….

The course aims at the following general competences

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Production of free, creative and inductive thinking
Analytical and synthetic thinking
Meeting Deadlines and Keeping Schedules

(3) SYLLABUS

- What is soft matter, intermolecular interactions, interfaces.
- Mesophases, mesogens, order, disclinations, elasticity, anchoring, phase transitions, physical properties, Freedericksz transition, liquid crystal displays.
- Amphiphiles, micelles, self-organization, shape and geometry, membranes, vesicles, curvature elasticity.
- Solutions, electrolytes, double layer, screening potential, Poisson-Boltzmann theory, Debye-Huckel approximation.
- Colloids, Brown motion, Langevin equation, DLVO theory, stabilization, aggregation kinetics, osmotic pressure with interactions, electrokinetic effects.
- Polymers, chain models (ideal, freely rotated, worm like, gaussian chain) entropy, energy, radius of gyration, Kahn length, persistence length, Flory - Huggens theory, θ-temperature, self-similarity, self-avoidance, Flory theory.
- Proteins, coil-globule and helix-coil transition.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Yes Electronic communication with the students usingICT (Information and Communications Technology) Computer-aided lectures, use of Overhead Projectors, Eclass platform
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

Activity	Semester workload
Lectures	40
Exercises	12
Individual Study Preparation	75
Study and Analysis of bibliography	9
Exercises	8
Exams	6
CourseTotal	**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.*	Final written exams in Greek (90%) Open-ended questions, Problem solving (10%) Mid-term written examination

(5) ATTACHED BIBLIOGRAPHY

- Suggestedbibliography

- Διεπιφανειακά Φαινόμενα και Κολλοειδή Συστήματα, Κ. Παναγιώτου, Εδόσεις ΖΗΤΗ Ο.Ε, 1998.
- Ι. Λελίδης, Σημειώσεις: Φυσική Υγρών Κρυστάλλων, 2014.
- Atkins, Φυσικοχημεία, ΙΤΕ Πανεπιστημιακές Εκδόσεις Κρήτης.
- P.G. de Gennes, J. Prost, The Physics of Liquid Crystals, Oxford, 2003.
- T. A. Witten, Structured Fluids, Oxford University Press (2004).
- T. Cosgrove, Colloid Science Principles, methods and applications, Wiley 2010.
- R.J. Young and P.A. Lovell, Introduction to polymers, CRC Press, 2011.
- S.A. Safran. Statistical thermodynamics of surfaces, interfaces and membranes. West view Press, Boulder, CO, (2003).
- J. Israelachvili. Intermolecular and surface forces. Academic Press, London, second edition, 1992.
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- T. L. Hill, An introduction to statistical thermodynamics, Dover, 1986.
- S. Chandrasekhar, Liquid crystals, Cambridge University Press, 1993.
- Broer, Dirk et al, Liquid crystal sensors, CRC Press, 2017
- Nanoscience with Liquid Crystals, From Self-Organized Nanostructures to Applications , Edr. Quan Li, Springer 2014.