COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**10YKO34**	**SEMESTER**	**5**
COURSE TITLE	**Statistical Physics I**		

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)	5	7

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (occasionally English for ERASMUS students)
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.uoa.gr/courses/PHYS140/

(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 course introduces the foundations of statistical mechanics which lead to a statistical interpretation of thermodynamics within the framework of microcanonical, canonical, grand canonical and isobaric-isothermal ensembles. The developed methods of statistical mechanics are then used to describe the statistics for ideal classical, Bose-Einstein, Fermi-Dirac and photon gases. Selected physical examples, covering different realizations of matter at a macroscopic level, are discussed in some detail.

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

- define thermodynamic quantities in terms of microscopic description;
- recognize the relevant conditions characterizing the equilibrium properties of macroscopic systems
- describe thermodynamically non-interacting systems with many degrees of freedom;
- explain statistical physics and thermodynamics as logical consequences of the postulates of statistical mechanics;
- solve selected problems employing principles of statistical mechanics;
- apply techniques from statistical mechanics to a wide range of systems;
- use the tools, methodologies, language and conventions of statistical physics to test and communicate ideas and explanations;
- to understand the physical explanations hiding behind experimental observations;
- develop a feeling for the appropriate strategy to analyze efficiently the thermodynamic behavior of macroscopic systems.
- To understand basic concepts of phase transitions

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…*
	…….

By successfully attending and completing the course the student will acquire the following skills:

- Ability to search, analyze and compose data and information, using the appropriate technological tools.
- Ability to work autonomously.
- Train free, creative and inductive thinking.
- Train analytical and synthetic thinking.
- Ability to solve problems.

(3) SYLLABUS

- Foundations of classical statistical physics.
- Isolated system, microcanonical ensemble.
- System in a thermal bath, canonical ensemble.
- System in a thermal bath at constant pressure, isobaric-isothermal ensemble
- Open system, the grand canonical ensemble.
- Interacting systems. Phase transitions. Mean field theory. Lattice Gas model
- Quantum statistics, Bose-Einstein and Fermi-Dirac distributions.
- Ideal quantum gases, degenerate Fermi-gas, Bose-Einstein condensation.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Yes

Electronic communication with the students using ICT (Information and Communications Technology)
Computer-aided lectures, use of Overhead Projectors,
e-class platform</td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Exercises</td><td>26</td></tr>
<tr><td>Individual Study</td><td>110</td></tr>
<tr><td>Course Total</td><td>175</td></tr>
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<tr><td>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.</td><td>Final written exam in Greek
Open-ended questions, Problem solving</td></tr>
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(5) ATTACHED BIBLIOGRAPHY

- F. Mandl, «Στατιστική Φυσική», Α.Γ. ΠΝΕΥΜΑΤΙΚΟΣ, Επιστημονικές και Τεχνολογικές Εκδόσεις
- Ε.Ν. Οικονόμου, «Στατιστική Φυσική & Θερμοδυναμική», ΙΤΕ Παν/μιακές ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ
- Σ. Ευαγγέλου, «Στατιστική Φυσική Ι & ΙΙ», ΕΚΔΟΣΕΙΣ ΠΑΠΑΖΗΣΗ
- M. Kardar, "Statistical Physics of Particles", Cambridge University Press