COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF PHYSICS		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**M113**	**SEMESTER**	**1**
COURSE TITLE	STATISTICAL 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**
	5	10
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*	General background, specialised general knowledge
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	

(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 objective of this course is to remind the graduate students of the basic principles of the undergraduate Statistical Physics and to induct them to advanced ideas and methods of this scientific discipline. After the end of this course, the graduate student should be able to :

1. Recall and use with ease the basic principles and quantities of Thermodynamics as well as the most important probability distributions.
2. Choose the appropriate statistical ensemble (micro-canonical, canonical and grand-canonical) depending on the constraints that apply to the system.
3. Use the appropriate statistical ensemble in order to fully describe a variety of physical systems, from the photonic gas to lattice vibrations.
4. Recall the basic principles of the Quantum Statistical Physics, and apply them to a plethora of fermionic and bosonic systems.
5. Describe phenomena in realistic systems such as phase transitions, Van der Waals interactions and broken symmetries.

6. Recall the basic principles and description methods of modern phenomena such as super-fluidity and super-conductivity.

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…*
	…….

Search for, analysis and synthesis of data and information
Decision-making
Working independently
Criticism and self-criticism
Production of free, creative and inductive thinking

(3) SYLLABUS

Basic Principles of Thermodynamics. Probability distributions. Kinetic theory (Liouville's theorem, Boltzmann equation). Statistical ensembles (micro-canonical, canonical and grand-canonical). Applications in non-interacting systems. Applications in interacting systems (Van der Waals gases, phase transitions, critical phenomena). Quantum Statistical Physics: quantum effects in molecular gases, phonons, photons, density matrix. Identical particles: degenerate quantum gases, fermionic liquids, Bose-Einstein condensation, super-fluidity, super-conductivity.

(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*	Use of the course web page on http://ecourse.uoi.gr to post notes and exercise sheets Use of electronic mail to communicate with the students
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*	
STUDENT PERFORMANCE EVALUATION	

Activity	***Semester workload***
Lectures	55
Problem Solving	15
Independent Study	100
Homeworks	45
Students' Presentations	30
Exams	5
Course total	***250***

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.*	Problem solving (every second week) and submission for assessment Written field-work and oral presentation by the students during the semester on untaught material End-of-semester written exams during which the students are asked to solve problems related to the material taught at the course

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. "Statistical Mechanics", Kerson Huang, 2nd Edition, Wiley, 1987.
2. "Statistical Mechanics", R.K. Pathria, Pergamon Press, 1972.
3. "Statistical Mechanics", S.K. Ma, World Scientific Publishing Company, 1985.
4. "Introduction to Quantum Theory of Many Degrees of Freedom", Evangelos Manessis, University of Ioannina, 1996.

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