ETY301 - Classical and Statistical Thermodynamics

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETY301	**SEMESTER**	3
COURSE TITLE	Classical and Statistical Thermodynamics		

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

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	Special background
PREREQUISITE COURSES:	Calculus, elements of modern physics.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=736

(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 gives the essential **knowledge** of the foundations of statistical thermodynamics, in the framework of which can the concepts of temperature, heat and entropy be strictly defined from first principles and be truly understood without resorting to empirical or axiomatic approaches.

The students acquire **skills of a tool** for calculating thermal properties of quantities that are related to Solid State Physics, Optical, Electrical and Magnetic Properties of mater, Semiconductors, Magnetic Materials, Superconducting, Materials, Phase Diagrams, Physical Metallurgy. In many cases it is a prerequisite for these courses.

These skills are also required for building models in numerical calculations that involve statistical ensembles. Emphasis is given so that the examples studied within the course can be easily generalized and provide an **analytical tool** to any class of material or system the student will have to deal with in **analyzing, designing or optimizing**.

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…* *…….*
basic general knowledge basic skills required to derive thermodynamic properties Production of free, creative and inductive thinking Working independently	

(3) SYLLABUS

Synopsis of classical thermodynamics, Thermodynamic laws, potentials, Gibbs-Duhem and Maxwell equations. Examples: thermodynamic gas cycles, thermal machines and refrigerators. Basic concepts of probability theory and statistical distributions. Basic thermodynamic concepts in relation to micro and macrostates. Statistical weight of a macrostate, Boltzman definition of entropy, Microcanonical ensemble. Examples: Entropy and enthalpy of mixing in a binary alloy, Schottky defects, paramagnetic spins. General definition of entropy. Entropy and information. Canonical ensemble, Boltzman distribution and partition function. Lattice vibrations in crystals. Third law of thermodynamics. Partition function for the classical ideal gas. Maxwell velocity distribution, equipartition theorem. Grand canonical ensemble. Quantum gases Bose-Einstein, Fermi-Dirac and photon distributions. Free electron gas, black body radiation.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class, lectures and asynchronous (e-course)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with 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*	

Activity	*Semester workload*
Lectures	39
Tutorials	13
Self-study	48
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,*	LANGUAGE OF EVALUATION: Greek METHOD OF EVALUATION:

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 examination

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

- «ΣΤΑΤΙΣΤΙΚΗ ΦΥΣΙΚΗ», F. MANDL, 978-960-7258-79-3, ΠΝΕΥΜΑΤΙΚΟΣ
- «ΣΤΑΤΙΣΤΙΚΗ ΦΥΣΙΚΗ» ΜΟΥΣΤΑΝΗΣ ΠΑΝΑΓΙΩΤΗΣ, 978-960-456-304-3, ΖΗΤΗ ΠΕΛΑΓΙΑ & ΣΙΑ Ο.Ε.
- «Στατιστική Φυσική», Βέργαδος Ιωάννης ,Τριανταφυλλόπουλος Ηλίας. Εκδόσεις: ΑΡΗΣ ΣΥΜΕΩΝ
- «Στατιστική Φυσική και Θερμοδυναμική», Ε.Ν Οικονόμου. Εκδόσεις: ΠΕΚ
- «Στατιστική Φυσική, Μαθήματα Φυσικής Berkeley 5», Εκδόση: ΠΕΚΕΜΠ
- «Στατιστική Φυσική», Ευαγγέλου. Εκδόσεις: ΠΑΠΑΖΗΣΗ
- «Στατιστική Φυσική της Θερμοδυναμικής Ισορροπίας,» Χ. Ζεγκίνογλου. Εκδόσεις: ΠΕΡΙΤΕΧΝΩΝ.

-Related academic journals:

- Journal of Thermodynamics
- Journal of Statistical Mechanics: Theory and Experiment