COURSE OUTLINE

(1) GENERAL

SCHOOL	PHYSICAL SCIENCES		
ACADEMIC UNIT	PHYSICS		
LEVEL OF STUDIES			
COURSE CODE	215	**SEMESTER**	6,8
COURSE TITLE	PHYSICAL CHEMISTRY		

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**
	4	4
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)	https://ecourse.uoi.gr/course/view.php?id=3576

(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*

Physical Chemistry provides a strong and critical background on important physical chemistry concepts from chemist's point of view. At the end of the semester the student will be able to

- know the structure of nuclei and become familiar with simple nuclear models such as the shell model, predict nuclear spin and explore its applications in physics, chemistry and medicine
- know the electromagnetic spectrum and the importance of particle-wave theory, predict the color of a compound, explain Bohr's theory of the hydrogen, hydrogen-like and exotic atoms
- describe the electronic configuration of atoms and its relation to chemical reactivity, understand the great importance of atomic orbitals and spin concepts in chemical reactivity
- apply the crystal field theory in explaining the color and magnetic properties of

transition metal compounds

- know the molecular orbital theory as a powerful tool for predicting simple compounds and their properties (e.g., optical properties & particle-in-a-box, magnetic properties)
- predict the molecular geometry of polyatomic molecules and dipole moment, find the hybridization of central atom
- schematically diagram simple cubic, body-centered cubic and face-centered cubic unit cells, as well as compute theoretical values, such as density, lattice energy, F-centers
- know the dependence of melting/boiling point on pressure (Clausius-Clapeyron relation) and its practical applications in chemistry
- know the wide range of application of the kinetic theory of gases through several working examples
- estimate energy value of fuels through the ΔH of chemical reactions, apply calorimetry with chemical reactions, calculate the energy of nuclear reactions
- apply the thermodynamic and kinetics criterion in chemical reactions, know the effect of temperature and pressure on Gibbs free energy change, apply the integrated rate law for chemical reactions of zero, first and second order
- apply the principles of electrochemistry in electrolysis (prediction of products-Faraday's law-industrial applications) and galvanic cells (batteries: voltage and energy value, cathodic protection)

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…
…….

Stimulation of creative thinking
Connection of theory with practical applications

(3) SYLLABUS

Isotopes & nuclear structure: definitions, nuclear shell model, nuclear spin and applications. Electromagnetic radiation & atoms: electromagnetic spectrum, Bohr's atomic model & applications, exotic atoms. Electronic configuration: aufbau principle, electronic structure & chemical reactivity, periodic table. Crystal field theory: octahedral & tetrahedral geometry, high spin/low spin systems, d-d transitions (Laporte rule, spin-allowed/spin forbidden), Jahn-Teller effect, optical & magnetic properties. Molecular orbitals: molecular orbital theory for diatomic molecules & conjugated polyenes as a prediction tool of molecules & properties, particle-in-a-box. Molecular geometry: Lewis structure, VSEPR theory, hybridization, dipole moment. Crystal structure: simple, body- and face-centered cubic structure, diamond & graphite structure, theoretical density calculations, lattice energy, F-centers. States of matter: Clausius-Clapeyron relation & kinetic theory of gases. Thermochemistry: energy value of fuels, biological fuels, nuclear energy. Chemical thermodynamics: Gibbs free energy change ΔG of chemical reactions, effect of temperature and pressure on ΔG. Chemical kinetics: speed of reaction, integrated rate laws. Electrochemistry: electrolytic cells, products of electrolysis, Faraday's law, galvanic cells, electrochemical potentials, batteries, cathodic protection.

(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*	-Power Point presentation using laptop and projector -Email communication -Ecourse communication
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
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*	-Final writing test at the end of semester (problems solving) -Assigned homework and presentation at the end of semester

Activity	***Semester workload***
Lectures	39
Tutorials/Exercises	13
Student's study hours	30
Exam	3
Course total	***85***

examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography: *- Related academic journals:* **-General Chemistry, Darell Ebbing & Steven Gammon, Greek translation, Publisher TRAVLOS (2002) (EUDOXUS)** **-Physical Chemistry-Basic approach, Written in Greek, N. A. Katsanos, 3rd edition, Publisher PAPAZISI (1990) (EUDOXUS)**