COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
DEPARTMENT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	ISCED level 6 – Bachelor's or equivalent level		
COURSE CODE	YN102	**SEMESTER**	1st Semester
COURSE TITLE	GENERAL CHEMISTRY		

TEACHING ACTIVITIES *If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.*	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
	7	7
THEORY	4	
LABORATORY EXERCISES	3	
Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.		

COURSE TYPE *Background, General Knowledge, Scientific Area, Skill Development*	General Background
PREREQUISITES:	NO
TEACHING & EXAMINATION LANGUAGE:	Greek
COURSE OFFERED TO ERASMUS STUDENTS:	NO
COURSE URL:	https://eclass2.emt.duth.gr/courses/CHEM-N1101/

(2) LEARNING OUTCOMES

Learning Outcomes
Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.

The course aims to provide students with an understanding of the basic principles of Chemistry that are essential for their theoretical and laboratory training.

Upon successful completion of this course, students will be able to:

- Balance chemical reactions, predict the direction of reactions and the stability of oxidation states.
- Calculate the quantities of required reactants and expected products as well as the yield of a chemical reaction.
- Predict and understand the changes in the characteristic properties of the elements in the periodic table.
- Apply the rules of quantum numbers, to calculate the energy of photons, the wavelength and the frequency of transitions in the hydrogen atom.
- Use Lewis, VSEPR, valence bond and molecular orbital theories with ease and predict the geometry, hybridization, bond order and magnetic behavior of compounds.
- Distinguish the types of intermolecular forces, differences in solubility and volatility, viscosity and surface tension of compounds.
- Recognize Brönsted-Lowrry and Lewis acids and bases and to predict their strength, based on the molecular structure.
- Easily describe acid-base balance, buffer solutions, common ion effect and precipitation-dissolution of sediments.

- Calculate basic thermodynamic quantities (enthalpy, entropy, equilibrium and reaction rate constants)
- Understand basic electrochemical properties (cell potentials, corrosion and protection).

Knowledge

Knowledge and understanding of concepts and principles related to:
• the structure of atoms and molecules
• the periodic properties of the elements
• acid-base equilibrium
• redox and electrochemical reactions
• types of chemical bonds
• intermolecular forces

Skills

• Skills in distinguishing the types of chemical bonds
• Skills in predicting the periodic properties of elements
• Skills in predicting the structure and geometry of molecules
• Skills in predicting the solubility, precipitation and dissolution of salts and the direction of reactions
• Skills in problem solving

Abilities

• Ability to apply acquired knowledge to solve problems related to General Chemistry at an introductory level
• Ability to estimate the important periodic properties of the elements
• Ability to predict the yield of reactions
• Ability to interpret the types of chemical bonds and the geometry of molecules
• Ability to predict the direction of reactions, solubility and precipitation of salts

General Skills

Name the desirable general skills upon successful completion of the module

Search, analysis and synthesis of data and information,	*Project design and management*
ICT Use	*Equity and Inclusion*
Adaptation to new situations	*Respect for the natural environment*
Decision making	*Sustainability*
Autonomous work	*Demonstration of social, professional and moral responsibility and*
Teamwork	*sensitivity to gender issues*
Working in an international environment	*Critical thinking*
Working in an interdisciplinary environment	*Promoting free, creative and inductive reasoning*
Production of new research ideas	

The general knowledge that the course aims to achieve and that students must have acquired are:
• Search, analysis and synthesis of information using the necessary technologies
• Independent work
• Teamwork
• Ability to apply knowledge to solve problems
• Promotion of free, creative and inductive thinking
• Decision-making

(3) COURSE CONTENT

THEORY:
- Nomenclature of inorganic compounds. Acids, bases, salts, oxides, peroxides.
- Expressions of content and concentration of solutions.
- Chemical substitution and redox reactions. Stoichiometry and efficiency of chemical reactions.

- Periodic Table, atomic and ionic radius, electron affinity, electronegativity, polarizability, ionization energy, inert pair effect, diagonal relationships, metals, nonmetals, metalloids.
- Quantum theory, electromagnetic radiation, uncertainty principle, hydrogen atom, energy levels, energy quantization. Quantum numbers, atomic orbitals, electronic structure, stable configurations.
- Chemical bond, Lewis structures, standard charge, coordination. VESPR model, molecular geometry, bond-valence theory, hybridization. Molecular orbital theory MO, bond order, homonuclear and heteronuclear diatomic molecules.
- States of matter. Ideal and real gases, gas laws and equations. Liquids, intermolecular forces, viscosity, surface tension, ionic liquids, liquid crystals. Solids, metallic, ionic and polymers, nanomaterials.
- Acid-base equilibrium, Brönsted-Lowry, Lewis's acids-bases, pH, strong and weak acids-bases, ionization constants, buffer solutions. Solubility product, common ion effect, selective precipitation and dissolution.
- Chemical Thermodynamics, enthalpy, entropy, free energy of reactions, thermochemistry. Chemical equilibrium, constants Kc and Kp, LeChatelier's principle, applications.
- Chemical Kinetics, reaction rates and orders, reaction mechanisms, activation energy, catalysis.
- Electrochemistry, cell potentials, batteries, fuel cells, electroplating, electrolytic collection and purification of metals.
- Nuclear Chemistry, radioactivity, fission, fusion, radiation.

LABORATORY:

- Introduction to Chemistry Laboratories. Safety Rules - Basic Laboratory Equipment.
- Basic Laboratory Techniques. Measurement of mass of solids and liquids - Measurement of volume of liquids - Filtration - Centrifugation - Evaporation - Heating - Calcination - Drying - Drying Agents.
- Solutions. Preparation of solutions of known concentration.
- Electrolytes - Indicators - Measurement of pH.
- Categories of Chemical Reactions.
- Oxidation and Reduction - Redox reactions.
- Chemical Equilibrium - Effect of concentration and temperature on complex formation reactions.
- Introduction to Electronic Spectroscopy. Ultraviolet-visible spectroscopy (UV-vis).
- Chemical Kinetics. Determination of the reaction order of the hydrolysis of thiosulfate ions.
- Introduction to chemical literature.

(4) LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD *Face to face, Distance learning, etc.*	Face to face. Constant questions.
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) *Use of ICT in Teaching, in Laboratory Education, in Communication with students*	Presentations with Powerpoint, video, animation. Posting of supplementary notes and exercises on the e-class electronic platform.
TEACHING ORGANIZATION *The ways and methods of teaching are described in detail.* *Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.*	

Activity	Workload/semester
Lectures	52
Individual study-preparation	120
Assessment preparation	3
Total	175

The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.	
STUDENT EVALUATION *Description of the evaluation process* *Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others* *Please indicate all relevant information about the course assessment and how students are informed*	**Student evaluation languages** Greek **Method (Formative or Concluding)** Summative **Student evaluation methods** Written final exam with extended answer questions, multiple choice questions, judgment, development and problem solving.

(5) SUGGESTED BIBLIOGRAPHY

- ΑΡΧΕΣ ΤΗΣ ΧΗΜΕΙΑΣ, Η ΑΝΑΖΗΤΗΣΗ ΤΗΣ ΓΝΩΣΗΣ, Peter Atkins, Loretta Jones, Leroy Laverman, Εκδόσεις UTOPIA, ISBN: 978-618-5173-38-8, ΚΩΔΙΚΟΣ ΕΥΔΟΞΟΥ: 77111120.
- ΧΗΜΕΙΑ, Η ΚΕΝΤΡΙΚΗ ΕΠΙΣΤΗΜΗ, Brown, Lemay, Bursten, Murphy, Woodward, Stoltzfus, Εκδόσεις ΤΖΙΟΛΑ, 13 έκδοση/2016, ISBN: 978-960-418-515-3, ΚΩΔΙΚΟΣ ΕΥΔΟΞΟΥ: 50655974.
- ΑΝΟΡΓΑΝΗ ΧΗΜΕΙΑ, τόμος Ι, MARC WELLER, TINA OVERTON, JONATHAN ROURKE, FRASER ARMSTRONG, Εκφόσεις; BROKEN HILL PUBLISHERS LTD, ISBN: 9789925576319, ΚΩΔΙΚΟΣ ΕΥΔΟΞΟΥ: 94644953.
- Γενική Χημεία, Darell Ebbing, Steven Gammon, έκδοση 1η/2011, Εκδόσεις: ΤΡΑΥΛΟΣ & ΣΙΑ ΟΕ, ISBN: 9786185061364, ΚΩΔΙΚΟΣ ΕΥΔΟΞΟΥ: 122094112.
- Εργαστηριακές ασκήσεις γενικής και ανόργανης χημείας, Ακρίβος Περικλής, Καραγιαννίδης Πέτρος, Έκδοση 2η/2005, Εκδόσεις ΖΗΤΗ.
- ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΓΕΝΙΚΗΣ ΚΑΙ ΑΝΟΡΓΑΝΗΣ ΧΗΜΕΙΑΣ, Μ. ΛΟΥΛΟΥΔΗ, Σ.Κ. ΧΑΤΧΗΚΑΚΟΥ, Ν. ΧΑΤΖΗΛΙΑΔΗΣ, Εκδόσεις ΣΩΤΗΡΙΟΣ ΧΑΤΖΗΚΑΚΟΥ, έκδοση 2/2002.

Related scientific journals:

- Journal of Chemical Education
- Dalton Transactions
- Inorganic Chemistry