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	YN201	**SEMESTER**	2nd
COURSE TITLE	Inorganic Chemistry I		

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**
THEORY	4	7
LABORATORY	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 backround
PREREQUISITES:	NO
TEACHING & EXAMINATION LANGUAGE:	Greek
COURSE OFFERED TO ERASMUS STUDENTS:	NO
COURSE URL:	https://eclass2.emt.duth.gr/courses/CHEM-N2101/

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 an understanding of the basic principles of Inorganic Chemistry that are essential for the theoretical and laboratory training of students. After successfully completing the course, the student is expected to:

- Understand the different physical and chemical behavior of the elements depending on their position in the Periodic Table.
- Recognize the distinct behavior of the first- and second-period elements compared to elements of the subsequent periods.
- Explain and describe physicochemical properties based on molecular interactions and bonding.
- Understand and interpret the reaction mechanisms of various inorganic compounds.
- Understand the laboratory and industrial methods for producing main-group elements and their compounds.
- Understand the processes and methods involved in converting raw materials into useful industrial products.
- Understand the properties of metals, corrosion, and methods for corrosion protection.
- Solve problems related to the basic principles of Inorganic Chemistry, including the prediction of new compounds and products with potential technological interest.

Knowledge
Students will acquire knowledge and understanding of concepts and principles related to:

- The properties of main-group elements in the periodic table.

- The unique characteristics of first- and second-period elements compared to elements of other periods.
- Understanding and interpreting the mechanisms of reactions involving various inorganic compounds.
- The reactions used to prepare main-group elements and their compounds with other elements.
- The application of basic chemical concepts (hybridization, atomic and molecular orbitals, types of chemical bonding, intermolecular forces, as well as thermodynamic, kinetic, and electrochemical principles).
- Linking chemical knowledge with practical applications in everyday life and industry.

Skills

- Skills in applying the basic principles and concepts of General and Inorganic Chemistry.
- Skills in predicting periodic properties of main-group elements.
- Skills in understanding and using reaction mechanisms of various inorganic compounds.
- Skills in solving Inorganic Chemistry problems related to main-group elements and their compounds.
- Skills in applying fundamental concepts of Inorganic Chemistry to the production of useful products (detergents, soda, ammonia, sulfuric acid, nitric acid, etc.).

Competencies

- Ability to apply acquired knowledge to address introductory-level Inorganic Chemistry problems.
- Ability to combine knowledge to tackle more complex problems.
- Ability to predict and evaluate important characteristic properties of elements.
- Ability to assess specific chemical processes used to produce useful products.

General Skills

Name the desirable general skills upon successful completion of the module

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

The general competencies targeted by the course, which students are expected to acquire, include:

- Searching for, analyzing, and synthesizing information using appropriate technologies
- Independent work
- Teamwork
- Ability to apply knowledge to problem solving
- Development of free, creative, and inductive thinking
- Decision-making

3. COURSE CONTENT

THEORY:

- Hydrogen: preparation, properties, uses, isotopes, hydrogen compounds, hydrides, complexes.
- Oxygen: preparation, properties, uses, ozone, oxides, peroxides, ozonides; strong oxidizing agents, Fenton reagent, hydroxyl radicals.
- Metals: extractive metallurgy, pyrometallurgy, electrometallurgy, corrosion and metal protection.
- Group 1 (IA): Lithium, Sodium, Potassium, Rubidium, Cesium, Francium. Production, uses. Hydrogen, oxygen, and halogen compounds; complexes.
- Group 2 (IIA): Beryllium, Magnesium, Calcium, Strontium, Barium, Radium. Production, uses. Hydrogen, oxygen, and halogen compounds; carbonates; complexes.
- Group 13 (IIIA): Boron, Aluminum, Gallium, Indium, Thallium. Boranes, carboranes, borazines, complexes.

- Group 14 (IVA): Carbon, Silicon, Germanium, Tin, Lead. Allotropy, fullerenes, metal carbonyls, carbides, complexes; silanes.
- Group 15 (VA): Nitrogen, Phosphorus, Arsenic, Antimony, Bismuth. Ammonia, phosphine, hydrazine; oxides and oxoacids.
- Group 16 (VIA): Oxygen, Sulfur, Selenium, Tellurium, Polonium. Preparation, properties, uses; hydrogen, oxygen, and halogen compounds.
- Group 17 (VIIA): Fluorine, Chlorine, Bromine, Iodine, Astatine. Preparation, properties, uses; oxoacids; pseudohalogens.
- Group 18 (VIIIA): Noble gases He, Ne, Ar, Kr, Xe, Rn. Preparation, properties, uses; chemical behavior; noble-gas compounds.

LABORATORY:

- Inorganic Chemistry Laboratory Techniques – Laboratory Notebook.
- Fractional crystallization: construction of solubility curves of salts; crystallization and recrystallization of a salt; separation of KNO_3/NaCl by fractional crystallization.
- Salt synthesis: simple salts ($CaCO_3$), double salts ($(NH_4)_2Cu(SO_4)_2 \cdot 6H_2O$), and complex salts ($Cu(NH_3)_4SO_4 \cdot H_2O$).
- Synthesis and analysis of an iron complex salt: preparation and purification of the complex.
- Quantitative determination of oxalate ions in the iron complex by titration with standard potassium permanganate solution; determination of crystallization water.
- Quantitative determination of iron by UV-Vis spectrophotometry; determination of empirical and molecular formula of the complex.
- Synthesis of Tin(IV) iodide using heating under reflux.
- Identification of an unknown weak acid solution.
- Conductivity measurements and applications.
- Separation of cations by paper chromatography.

4. LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD *Face to face, Distance learning, etc.*	In-person lectures and laboratory exercises
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) *Use of ICT in Teaching, in Laboratory Education, in Communication with students*	Use of ICT (PowerPoint, videos, animations) and electronic notes for teaching both the Theory and Laboratory components. The lectures include sample solved problems in each chapter to facilitate understanding of the theoretical material. Face-to-face communication with students, as well as communication via email and the e-class 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.* *The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.*	

Activity	Workload/semester
Lectures (4 hours of in-person teaching × 13 weeks)	52
Laboratory (3 hours of in-person teaching × 13 weeks)	39
Study hours for writing laboratory reports	18
Study hours for preparing for the laboratory final examinations	25
Study hours for preparing for the final theory examinations	35
Final laboratory examination (3 hours, in person)	3

	Final theory examination (3 hours, in person)	3
	Course Total (25 hours of workload per credit unit)	175 hours (total student workload)
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*	The grading distribution for the mixed course Inorganic Chemistry II (Y501) is: Theory 60 percent – Laboratory 40 percent. Theory assessment is carried out through a written examination covering the entire syllabus. The written exam includes short-answer questions, extended-response questions, multiple-choice questions, and problem-solving exercises. The diligent and successful performance of the laboratory experiments (Grade A). This includes preparation, laboratory work, behaviour and consistency in the laboratory, as well as short written quizzes. The average grade of the laboratory reports submitted to the Instructor of the Laboratory Session (Grade B). The grade reflects the quality of presentation and evaluation of the experimental results, the interpretation of these results, and the correct answers to the questions in each laboratory report. Students are required to submit at least 80 percent of all laboratory reports. Otherwise, they are not permitted to take the final written examination and must repeat all Laboratory Sessions in a subsequent academic year. The final written examination covering the content of the Laboratory Sessions (Grade C). The written exam includes topics related to laboratory practice, the theoretical background of the experiments, and the relevant calculations. The final grade for the course “Inorganic Chemistry Laboratory I” is calculated as: Final grade (scale 0–10) = (0.2 × A) + (0.3 × B) + (0.5 × C). To successfully complete the laboratory, a student must obtain a grade equal to or greater than 5 in each component, that is: (A + B) ≥ 5 and C ≥ 5. The above assessment criteria are announced during the first academic week of classes. They are also posted on e-class and accessible to all students. The final examination is conducted in the Greek language.	

5. SUGGESTED BIBLIOGRAPHY

1. ΑΝΟΡΓΑΝΗ ΧΗΜΕΙΑ, τόμος Ι, MARC WELLER, TINA OVERTON, JONATHAN ROURKE, FRASER ARMSTRONG, ISBN: 978-9925-576-31-9, ΚΩΔΙΚΟΣ ΕΥΔΟΞΟΥ: 94644953.
2. ΒΑΣΙΚΗ ΑΝΟΡΓΑΝΗ ΧΗΜΕΙΑ, A. Cotton, G. Wilkinson,P. Gaus, Εκδόσεις ΠΑΡΙΣΙΑΝΟΥ, ISBN: 978-960-6830-663, ΚΩΔΙΚΟΣ ΕΥΔΟΞΟΥ:50660073.
3. Εργαστηριακές ασκήσεις γενικής και ανόργανης χημείας, Ακρίβος Περικλής, Καραγιαννίδης Πέτρος, Έκδοση 2η/2005, Εκδόσεις ΖΗΤΗ, ISBN: 960-431-556-0,ΚΩΔΙΚΟΣ ΕΥΔΟΞΟΥ: 11008. ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΓΕΝΙΚΗΣ ΚΑΙ ΑΝΟΡΓΑΝΗΣ ΧΗΜΕΙΑΣ, Μ. ΛΟΥΛΟΥΔΗ, Σ.Κ. ΧΑΤΖΗΚΑΚΟΥ, Ν. ΧΑΤΖΗΛΙΑΔΗΣ, Εκδόσεις ΣΩΤΗΡΙΟΣ ΧΑΤΖΗΚΑΚΟΥ, έκδοση 2/2002, ISBN: 960-90958-0-1, ΚΩΔΙΚΟΣ ΕΥΔΟΞΟΥ: 148946.
4. Σύνθεση και μελέτη σύμπλοκων ενώσεων, Ακρίβος Π., Ασλανίδης Π., Καραγιαννίδης Π., 1η έκδοση/1999, Εκδόσεις ΖΗΤΗ, ISBN 960-431-514-5, ΚΩΔΙΚΟΣ ΕΥΔΟΞΟΥ: 11288.
5.

Relevant scientific journals:

- Inorganic Chemistry
- European Journal of Inorganic Chemistry
- Dalton TransactionsAll other relevant scientific journals