

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	YN202	SEMESTER	2 nd Semester
COURSE TITLE	Analytical Chemistry I		
TEACHING ACTIVITIES <i>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.</i>	TEACHING HOURS PER WEEK	ECTS CREDITS	
Theory	4	6	
Lab	3		
<i>Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.</i>			
COURSE TYPE <i>Background, General Knowledge, Scientific Area, Skill Development</i>	<ul style="list-style-type: none"> • General Background • General Knowledge • Skills Development 		
PREREQUISITES:	No		
TEACHING & EXAMINATION LANGUAGE:	Greek		
COURSE OFFERED TO ERASMUS STUDENTS:	No		
COURSE URL:	https://eclass2.emt.duth.gr/courses/CHEM-N2102/		

(2) LEARNING OUTCOMES

<p>Learning Outcomes <i>Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.</i></p>
<p>The primary objective of this course is to equip students with a comprehensive understanding of the fundamental principles and methodologies of Classical Analytical Chemistry. Emphasis is placed on qualitative analysis, chemical equilibria, and the systematic application of analytical techniques to various types of samples. The course aims to cultivate precision, critical thinking, and adherence to safety and quality standards in laboratory practice, thereby preparing students for advanced studies and professional work in chemical analysis.</p> <p>Upon successful completion of the course, the student is expected to:</p> <ul style="list-style-type: none"> • Understand and assimilate the fundamental principles of qualitative analysis • Understand and assimilate the basic principles of chemical equilibrium and the factors affecting it • Select and successfully apply an appropriate qualitative analysis method depending on the sample and the requirements of the analysis • Understand and comply with safety regulations in an analytical chemistry laboratory • Become familiar with as many laboratory instruments and devices of an analytical chemistry laboratory as possible • Understand the calculation methods for solution concentrations and their preparation, and present results according to international standards

- Successfully identify and evaluate errors in determinations
- Understand the theory and applications of Fundamental Analytical Chemistry

Knowledge

- Knowledge and understanding of all fundamental concepts and principles of chemical equilibrium and the factors affecting it
- Knowledge and understanding of writing and balancing chemical equations – understanding of chemical reactions
- Knowledge of characteristic reactions of cations and anions
- Knowledge and understanding of solving problems related to chemical equilibrium, reaction kinetics, and qualitative analysis

Skills

- Ability to solve basic problems in analytical chemistry
- Evaluation of analytical chemistry problems
- Selection of appropriate techniques for solving analytical chemistry problems
- Integration of experimental data to solve analytical chemistry problems
- Performance of tests in a qualitative analysis laboratory (identification of anions and cations in solution)
- Evaluation of analytical chemical measurements
- Presentation of analytical chemical measurement results

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

Through the lectures and laboratory exercises, students are expected to acquire the following general competences:

- Ability to search for, analyze, and synthesize new concepts and information
- Ability to translate theory into practice
- Ability to apply knowledge to solve problems in analytical chemistry
- Execution, presentation, and evaluation of experimental results, including quality assurance procedures
- Ability to work independently in the collection and processing of analytical parameters
- Ability to collaborate effectively within a team to achieve educational objectives
- Decision-making skills
- Development of critical thinking and self-assessment
- Ability to work in an interdisciplinary environment
- Acquisition of a solid theoretical and practical background to support further studies at higher levels of education

(3) COURSE CONTENT

Theory

Week 1: Introduction to Analytical Chemistry, Fields of application of Analytical Chemistry

- Week 2: Chemical reactions – Chemical equations, Charge and mass balancing in chemical equations
- Week 3: Solutions – Solubility and solution concentration; physical and chemical units for expressing concentration, Activity
- Week 4: Reaction rate
- Week 5: Introduction to Chemical equilibrium
- Week 6: Distribution equilibrium between immiscible solvents
- Week 7: Acids and bases Theories, Equilibria of weak acids and bases
- Week 8: Water dissociation and the pH scale
- Week 9: Hydrolysis of salts
- Week 10: Buffer solutions
- Week 11: Heterogeneous chemical equilibrium – Solubility product
- Week 12: Equilibria of complex ions
- Week 13: Redox system equilibria

Lab

- Lab Exercise 1: Group allocation and Operation of the Analytical Chemistry Laboratory
- Lab Exercise 2: Safety Rules, Familiarization with laboratory safety regulations, emergency procedures, and proper use of laboratory facilities, Laboratory Organization and Data Recording, processing of experimental results, calculation of errors, and preparation of laboratory reports, Laboratory Equipment, Reagents, and Materials
- Lab Exercise 3: Characteristic Reactions for the Identification of Cations (1st part, known sample)
- Lab Exercise 4: Characteristic Reactions for the Identification of Cations (2nd part, unknown sample)
- Lab Exercise 5: Characteristic Reactions for the Identification of Anions (1st part, known sample)
- Lab Exercise 6: Characteristic Reactions for the Identification of Anions (2nd part, unknown sample)
- Lab Exercise 7: Laboratory-based introduction to the acid-based titrations (experimental set-up of the titration, burette reading, calculations)
- Lab Exercise 8: Alkalimetry I: Standardization of a sodium hydroxide solution
- Lab Exercise 9: Alkalimetry II: Determination of Potassium Hydrogen Phthalate (KHP) using a Standard Sodium Hydroxide Solution
- Lab Exercise 10: Acidimetry I – Standardization of HCl Solution
- Lab Exercise 11: Acidimetry II– Determination of Sodium Carbonate by Titration with Standard Hydrochloric Acid Solution
- Lab Exercise 12: Make-up Laboratory Sessions
- Lab Exercise 13: Final exam on the lab exercises

(4) LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD <i>Face to face, Distance learning, etc.</i>	Face to face	
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) <i>Use of ICT in Teaching, in Laboratory Education, in Communication with students</i>	Use of ICT in Teaching Use of ICT in Communication with students	
TEACHING ORGANIZATION <i>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,</i>	Activity	Workload/semester
	Lectures	52
	Lab	39
	Bibliographic research & analysis	30

<p><i>Study visits, Study / creation, project, creation, project. Etc.</i></p> <p><i>The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.</i></p>	Preparation for the final exams	26
	Final Exam	3
	Total	150
<p>STUDENT EVALUATION</p> <p><i>Description of the evaluation process</i></p> <p><i>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</i></p> <p><i>Please indicate all relevant information about the course assessment and how students are informed</i></p>	<p>Student evaluation languages</p> <p>Greek</p> <p>Method (Formative or Concluding)</p> <p>Summative</p> <p>Student evaluation methods</p> <ul style="list-style-type: none"> • Multiple-choice questions • True/False questions with clear justification • Short-answer questions • Critical thinking questions • Problem-solving exercises • Laboratory and experimental performance (applicable only to the Laboratory component) • The Laboratory grade contributes 30% to the final overall course grade (final test in the lab exercises once they are completed) <p>Rate</p> <p>100</p>	

(5) SUGGESTED BIBLIOGRAPHY

<p>Eudoxus</p> <ul style="list-style-type: none"> – Basic Principles of Analytical Chemistry, Themelis Dimitrios G., Ziti Publications, ISBN: 9789604565030, Eudoxus Book Code: 77108836 – Fundamentals of Analytical Chemistry, Skoog, West, Holler, Crouch, Kostarakis Publications, ISBN: 9786185295035, Eudoxus Book Code: 102076788 – Analytical Chemistry, Themelis Dimitrios G., Zotou Anastasia–Stella, Ziti Publications, ISBN: 9789604564842, Eudoxus Book Code: 68380342 – Analytical Chemistry, Gary D. Christian, Purnendu K. Dasgupta, Kevin A. Schug, Odysseus Publishing, ISBN: 978992574674, Eudoxus Book Code: 86199898 <p>Relevant scientific Journals:</p> <ol style="list-style-type: none"> 1. Journal of Chemical Education 2. Analytical Chemistry 3. Analytica Chimica Acta 4. Talanta 5. Chemistry Education, Research and Practice 6. World Journal of Chemical Education
