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	YN301	**SEMESTER**	3rd Semester
COURSE TITLE	Analytical Chemistry II		

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
Lab	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 • 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-N3101/

(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.

Upon successful completion of the course, the student is expected to:

• Understand the operation and proper use of the analytical balance for the preparation of standard solutions
• Understand the calculation and preparation of solution concentrations
• Comply with safety regulations in an analytical chemistry laboratory
• Become familiar with a wide range of laboratory glassware and analytical instruments
• Be able to perform titrations accurately
• Select appropriate indicators for titrations
• Present analytical results according to Greek and international standards
• Select and successfully apply suitable quantitative analysis methods depending on the sample and analytical requirements
• Identify, calculate, and evaluate analytical errors in determinations
• Understand the theory and applications of Classical Analytical Chemistry

Knowledge
• Knowledge and understanding of all classical methods of quantitative analysis and their application to real samples

Skills

• Ability to solve basic problems in analytical chemistry
• Evaluation of analytical chemistry problems
• Selection of appropriate titration techniques for solving quantitative analysis problems
• Combination of experimental data for solving analytical chemistry problems
• Performance of qualitative analysis tests (identification of anions and cations in solution)
• Execution of classical quantitative analysis experiments
• Correct use and reading of burettes
• Evaluation of analytical chemical measurements
• Presentation of analytical chemical measurement results

Competences

• Competence in designing analytical methodologies for the determination of chemical elements and compounds
• Competence in conducting complete analytical procedures, from sampling to data interpretation and reporting

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	

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 the solution of analytical chemistry problems
• Execution, presentation, and evaluation of experimental results, including quality assurance procedures
• Ability to work independently in the collection and processing of analytical parameters
• Capacity for teamwork and collaboration to achieve educational objectives
• Decision-making skills
• Development of critical thinking and self-assessment
• Ability to work in an interdisciplinary environment
• Acquisition of theoretical and practical knowledge that supports further education at higher levels

(3) COURSE CONTENT

Theoretical part

Week 1: Introduction to Quantitative Chemical Analysis – Classification of techniques and methods of quantitative analysis
Week 2: Classification of reagents and materials based on purity
Week 3: Errors in Chemical Analysis
Week 4: Principles of Volumetric Analysis I (Introduction)
Principles of Volumetric Analysis II (Calculations - Methodology)
Week 5: Acid–Base Titrations I (Introduction)
Acid–Base Titrations II (Calculations, Applications)
Week 6: Redox Titrations I (Introduction)

- Redox Titrations II (Calculations, Applications)

Week 7: Precipitation Titrations I (Introduction)
Precipitation Titrations II (Calculations, Applications)

Week 8: Complexometric Titrations - Applications of Complexometric Titrations – Water Hardness Determination

Week 9: Principles of Gravimetric Analysis, Applications and Calculations

Week 10: Descriptive Statistics of Analytical Results

Week 11: Calibration methods in quantitative analysis

Week 12: Characteristics of Standard Methods, Analytical Performance

Week 13: Revision/mock test (optional, no marks)/make-up classes (if necessary)

Laboratory part

Week 1: Group allocation and Operation of the Analytical Chemistry Laboratory

Week 2: Alkalimetry: Determination of the %m/m of a Na_2CO_3/$NaHCO_3$ mixture

Week 3: Permanganometry – Titration of Standard $KMnO_4$ Solution

Week 4: Permanganometry – Determination of Iron(II) by Titration with Standard $KMnO_4$ Solution

Week 5: Iodometry – Titration of I_2 with a standard sodium thiosulfate ($Na_2S_2O_3$)

Week 6: Iodometry – Determination of Chlorine in Commercial Products

Week 7: Complexometric Titrations – Titration of EDTA

Week 8: Complexometric Titrations – Determination of Water Hardness using EDTA

Week 9: Argentometry – Titration of Silver Nitrate Solution

Week 10: Argentometry - Determination of Chloride Ions with Silver Nitrate Solution)

Week 11: Gravimetric analysis of Fe

Week 12: Make-up lab courses

Week 13: Final test on all lab exercises

(4) LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD *Face to face, Distance learning, etc.*	Face to face
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) *Use of ICT in Teaching, in Laboratory Education, in Communication with students*	Use of ICT in Teaching Use of ICT in Communication with students
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	52
Lab	39
Bibliographic research & analysis	56
Preparation for the final exams	25
Final Exam	3
Total	175

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*	**Student evaluation languages** Greek **Method (Formative or Concluding)** Summative **Student evaluation methods**

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*	• 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) **Rate** **100**

(5) SUGGESTED BIBLIOGRAPHY

Eudoxus

- **Quantitative Chemical Analysis: Principles and Laboratory Applications**, Voulgaropoulos Anastasios, Zachariadis Georgios, Stratis Ioannis, Anthemidis Aristeidis, Ziti Publications, ISBN: 9789604562923, Eudoxus Book Code: 13006860
- **Analytical Chemistry**, Daniel C. Harris, Charles A. Lucy, Broken Hill Publishers, ISBN: 9789925576111, Eudoxus Book Code: 94644882
- **Analytical Chemistry**, Gary D. Christian, Purnendu K. Dasgupta, Kevin A. Schug, Odysseus Publishing, ISBN: 978992574674, Eudoxus Book Code: 86199898

Relevant scientific Journals:

- Analytical Bioanalytical Chemistry
- Microchemical Journal
- Journal of Chemical Education
- Analytical Chemistry
- Analytica Chimica Acta
- Talanta