3rd Semester (III) (first applied in 2017-18)

Analytical Chemistry-2

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XE356**	**SEMESTER**	**3rd**
COURSE TITLE	ANALYTICAL CHEMISTRY-2		
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**
Lectures		2	5
Seminars		-	
Laboratory work		5	
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*	Field of Science (Analytical Chemistry).		
PREREQUISITE COURSES:	The students should have a basic knowledge of General Chemistry.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. The course can be, however, taught in English in case foreign students attend the course.		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)			

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*

By the end of this course the student should:

1. Acknowledge the capabilities of the various quantitative analytical chemistry techniques and have the ability to compare them.
2. Have an understanding of modern analytical techniques applied widely in a variety of samples (e.g. biological samples, environmental samples, foodstuff, drugs, materials, artworks).
3. Present flexibility in combining analytical techniques to solve complex problems.
4. Have the ability to combine and exploit the knowledge gained also in other fields of Chemistry in which concepts of the current course are extensively used (e.g. Organic Chemistry, Biochemistry, etc.).

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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*Others*
Production of new research ideas	

By the end of this course the student will have further developed the following skills (general abilities):

1. Ability to exhibit knowledge and understanding of the essential facts, concepts, theories and applications related to Analytical Chemistry.
2. Ability to apply this knowledge and understanding to the solution of Analytical Chemistry problems of non-familiar nature.
3. Ability to adopt and apply methodology to the solution of non-familiar problems.
4. Study skills needed for continuing professional development.
5. Ability to interact with others in chemical or of interdisciplinary nature problems.
6. To work in a chemical lab following the safety rules.

Generally, by the end of this course the student will, furthermore, have developed the following general abilities (from the list above):

Searching, analysis and synthesis of facts and information, as well as using the necessary technologies

Adaptation to new situations

Decision making

Autonomous (Independent) work

Exercise of criticism and self-criticism

Promotion of free, creative and inductive thinking

3. SYLLABUS

- Classification of quantitative chemical analysis methods.
- Sampling, sample treatment, measurement techniques, instruments and chemical reagents.
- Statistical treatment of analytical data (accuracy, precision etc), errors in chemical analysis, significant figures, methods for reporting analytical data.
- Classification of gravimetric methods. Precipitation (homogeneous precipitation, crystal growth, colloids, impurities, digestion, errors in gravimetric analysis).
- Classification of titrimetric methods, standard solutions, indicators.
- Acid/base equilibria and titrations, complexometric titrations, precipitation titrations, reduction/oxidation titrations, acid-base titrations in non-aqueous solvents, errors in titrimetric analysis.
- Buffer solutions, titration curves for strong/weak acids and bases, mass balance and charge balance equations, errors.
- Evaluation and comparison of gravimetric and titrimetric analytical methods.
- Solving problems in the above chapters.

Laboratory exercises

- Introduction to the Laboratory of Analytical Chemistry-2 (instruments, chemical reagents, preparation of solutions, safety rules etc.)
- Determination of sodium carbonate (neutralization titration)
- Determination of calcium and total hardness of water with EDTA (complexometric titration).
- Determination of iron^{II} with potassium permanganate (redox titration)
- Determination of copper^{II} with iodide (iodometry)

- Determination of ascorbic acid with iodine (iodimetry)
- Determination of nicotine in tobacco (non-aqueous acid-base titration)
- Determination of nickel with dimethylglyoximate (gravimetric analysis)

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures and laboratory work face to face.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint) in teaching. Use of the Internet for the exploitation of scientific sites and the extraction of information from databases on Analytical Chemistry issues. Communication with the students is established either through email or through the webpage of the Chemistry Department.
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*	

Activity	*Semester workload*
Lectures (2 contact hours per week x 13 weeks)	26
Half-term evaluations (2, the first in the middle and the second one at the end of the semester, 1 contact hour each)	2
Laboratory work (5 contact hour per week x 12 weeks)	60
Final written examination (2 contact hours)	2
Hours for private study of the student and preparation for the half-term evaluations and/or the final examination.	35
Course total	***125***

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 examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	1. Optionally, half-term written examinations: one at the middle and the other one at the end of the semester. The final grade is the average of the two half-term examinations. The student should secure at least the grade 6 (0-10 scale) in the first half-term in order to participate in the second one. This score represents the 60% of the final grade of the course. 2. Written examination after the end of the semester (unless the student successfully participated in the half-term exams). Minimum passing grade: 5. This score represents the 60% of the final grade of the course. 3. Grade of laboratory work: This score is the 40% of the final grade of the course (minimum passing grade: 5). All of the above are taking place in the Greek language and for the foreign students (e.g. ERASMUS students) in English.

5. ATTACHED BIBLIOGRAPHY

1. D.C. Harris, "Quantitative Chemical Analysis", W.H. Freeman & Company, 2007.
2. G.D. Christian, P.K. Dasgupta, K.A. Schug, "Analytical Chemistry", J. Wiley & Sons, 2013.
3. D.A. Skoog, D.M. West, F.J. Holler, "Analytical Chemistry, An Introduction", Saunders College Publishing, 1992.
4. "Vogel's Textbook of Quantitative Chemical Analysis", Revised by G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denney, Longman Scientific & Technical, 1989.

5. T.P. Hadjiioannou, A.K. Kalokerinos, M. Timotheou-Potamia, “Quantitative Analysis”, Athens, 2017.
6. V. Nastopoulos, C. Papadopoulou, “Quantitative Analysis Laboratory Notes”, University of Patras Publication Centre, 2017.