Course Title	**Analytical Chemistry**				
Course Code	PHA106				
Course Type	Compulsory				
Level	BSc (Level 1)/ MPharm (Level 2)				
Year / Semester	1st (2nd semester)				
Teacher's Name	Dr Maria Rikkou-Kalourkoti				
ECTS	6	Lectures / week	3+1*	Laboratories/week	2
Course Purpose	The purpose of this course is to introduce students to: the acquisition of a sound knowledge of separation and identification of anions and cations, the analysis on unknown mixtures, e.g. minerals and alloys, the quantification methods for the various constituents of substances. Students are taught ways of sampling, quantitative analytical techniques and the physicochemistry-based spectrophotometric, chromatographic and electrochemical methods. This course prepares students to understand specific analytical pharmaceutical subjects, such as Pharmaceutical Analysis and Analytical Toxicology and to become familiar with analytical techniques and good laboratory practice. *tutorial				
Learning Outcomes	By the end of this course, the students should be able to: • Explain qualitative determinations of common ions and analyse unknown samples • Analyse various substances, e.g. ions, of particular interest in Pharmacy and Toxicology, such as heavy metals • Analyse the purity of samples, particularly solvents and reagents used in industry and laboratories • Employ gravimetric, titrimetric and complexometric analyses • Use quantitative analyses based on spectrophotometric techniques • Employ chromatographic as adjunct methods in quantitative analysis; • Apply the correct ways of sampling and perform analysis of simple pharmaceuticals • Apply safe laboratory practice				
Prerequisites	PHA101	Corequisites	None		
Course Content	Theory: Acid-base and oxidation-reduction reactions. Chemical equilibrium, weak acid-base dissociation, hydrolysis of salts. Heterogeneous (solubility products) and redox systems. Methods and Techniques in qualitative and quantitative chemical analysis. Reactions, separation, identification of cations and anions. Analysis of cations and anions in mixtures. Analysis of unknown samples, including alloys and/or minerals. Identification of				

	halogens, sulfur and nitrogen atoms covalently bonded in organic compounds. Laboratory procedures and safety in laboratory practice. Chemometrics and performance characteristics. Sampling techniques. Physicochemical processes, gravimetric analysis. Acid-base, complexometric, precipitation, redox titrations. Electrochemical analysis. Non aqueous titrations. Laboratory practice. Introduction to instrumental analysis. Spectroscopic analytical techniques (UV-vis, ^{1}H-NMR, atomic absorption spectrometry). Introduction to separation techniques using chromatography (flash-column, thin layer chromatography, HPLC, GLC). Introduction to electrophoresis. Errors in chemical analyses, statistical processing of analysis data **Laboratory experiments/exercises:** As part of the course, laboratory exercises are carried out on the course material for a better deepening and consolidation of the theoretical part. Indicative exercises are: detection of cations of 1st group, detection of cations of 4th group, detection of anions, determtion of water hardness, volumetric Determination of Cu^{2+}, determination of chlorine anions in water and gravimetric analysis of SO_4^{2-}
Teaching Methodology	Teaching methodology of the course includes lectures on the theoretical background and laboratory exercises / experiments to better understand and concepts of chemistry. The lesson uses PowerPoint presentations, picture-rich material, molecular models and short animations to better understand molecular geometry, stereochemistry and the effect on chemical and physical properties. Power point presentations are available for students through e-learning platform. During lectures students are challenged to explain (through discussions, questions and answers) are guided through basic chemistry concepts/principles. Related problems are presented and solved in the class and are also given to students for further practice at home. As part of the development of students' skills, laboratory exercises are carried out by the students (collection and analysis of data, apply theory and draw conclusions, completion of laboratory reports). Students submit written reports after each laboratory exercise.
Bibliography	Textbooks: (a) «Βασικές Αρχές Αναλυτικής Χημείας»,5η Έκδοση Δ. Γ. Θεμελής Εκδόσεις Ζήτη, 2018 . (b) Daniel C. Harris Quantitative Chemical Analysis 9th Edition. Publisher: W.H. Freeman & Co. 2016 (c) Daniel C. Harris. Ποσοτική χημική ανάλυση Τόμοι Α και Β, Επιμέλεια: Νίκος Χανιωτάκης, Μαρία Φουσκάκη, Πανεπιστημιακές Εκδόσεις Κρήτης, 2009 References: (d) Daniel C. Harris Ποσοτική χημική ανάλυση Τόμοι Α και Β,

	Επιμέλεια: Νίκος Χανιωτάκης, Μαρία Φουσκάκη, Πανεπιστημιακές Εκδόσεις Κρήτης, 2009. (e) Θ. Π. Χατζηϊωάννου, Α. Κ. Καλοκαιρινός, Μ. Τιμοθέου-Ποταμιά, Ποσοτική Ανάλυση, Αθήνα, 2006. (f) Θ Π. Χατζηιωάννου, Μ. Α. Κουππάρης Ενόργανη ανάλυση, 2005. (g) J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas, Vogel's Quantitative Chemical Analysis, Pearson Education, UK, 1989. (h) G. Svehla, Vogel's Qualitative Inorganic Analysis, Prentice Hall, 7th ed., 1979.
Assessment	Written Mid-Term Exam: 30% • Laboratory Reports: 20% • Written Final Exam: 50% The evaluation of the course is performed by (a) a written mid-term exam, which examines specific modules of the course and it accounts for 30% of the overall grade, (b) the laboratory grade which accounts for 20% of the overall grade, and (c) a written final exam, which examines all modules of the course, and it accounts for 30% of the overall grade. Students are prepared for the above written exams by solving problems, related to the course content (in class), while additional problems are given to the students for further practice. Frequent revisions are also performed to help students comprehend various chemical concepts and principles of techniques used in the field of study. The Mid-term and final examinations comprise include questions and numeric problems in order to evaluate the degree of understanding of the concepts and principles of chemistry and the ability to apply theory in solving problems, which require to use more than one concept or equation as well as investigation and/or quantification of equations. The Laboratory grade is extracted from the student's laboratory reports submitted after each experiment work, and one final examination. In Laboratory reports student must describe their experiment work (20 %), analyse their results (30%) and answer critical questions (50%), to examine the degree of understanding of the concept of the laboratory exercise. The laboratory final exam comprises of questions and numeric problems. The overall lab grade is calculated as shown in the equation: Lab grade = 0,60* (Average grade of laboratory reports) + 0,40* Lab final examination The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Language	Greek, English