

Study program: Integrated academic studies of Pharmacy			
Type and level of the study program: integrated academic studies			
Course title: ANALYTICAL CHEMISTRY II (PhII-ACHEMII)			
Teacher: Eva S. Lončar, Radomir V. Malbaša, Nataša P. Milošević, Vesna B. Tepavčević			
Course status: compulsory			
ECTS Credits: 6			
Condition: General chemistry; Inorganic chemistry			
Course aim The aim of this course is to introduce students to the theory and practice of classical quantitative chemical analysis with emphasis on pharmaceutical and other preparations important for the pharmaceutical profession.			
Expected outcome of the course: Students learn to apply the knowledge of analytical methods and sample preparation methods in the quantitative chemical analysis. Laboratory practice in the identification of various compounds, in model and real systems. Sample preparation and application of gravimetric and volumetric analyses.			
Course description			
<i>Theoretical education</i>			
<ol style="list-style-type: none"> Quantitative analysis. Methods. Comparison of analytical methods. Classification of analytes regarding the contents of components. Sample distribution regarding the size of samples. General course of analysis. Classical methods of quantitative analysis. Gravimetry. Types of gravimetric analyses. Gravimetric precipitation methods. Gravimetric evaporation methods. Stoichiometric calculations in gravimetry. Volumetric analysis. Basics of the volumetric analysis. Conditions for applying the chemical reaction in the volumetric analysis. Equivalence point and the end-point of titration. Determination of the equivalence point. Standard solutions: primary, secondary, and commercial standard solutions. Techniques of the volumetric analyses. Classification of the volumetric methods. Indicators. Classification of indicators. Calculations in volumetry. Acid-base titration. Application of acid-base titrations. Acidimetry. Alkalimetry. Titration curves. Potentiometric titration. Stoichiometric calculations. Precipitation titration. Conditions of applying the precipitation reaction in the volumetry. Classification of precipitation titrations. Argentometry (classification, application, indicators). Stoichiometric calculations. Complexometric titrations. Definition. Role. Titrations with inorganic complexing agents. Examples. Chelatometry. Stoichiometric calculations. Oxidation-reduction titrations (redox titrations). Types of redox methods. Primary standards. Indicators: redox, specific, inorganic. Equivalent point potentials. Titration curve: symmetrical and non-symmetrical. Permanganometry. Iodimetry (direct and indirect). Stoichiometric calculations. Acid-base titrations in non-aqueous medium. Properties and classification of organic solvents according to their acid-base characteristics. Levelling and differentiating effects of solvents. Determination of acids and bases in non-aqueous mediums. Data processing of the results of quantitative analysis. Criteria associated with the quality of analytical results. Accuracy and precision. Evaluation of the accuracy and precision. Errors in experimental measurements. Statistical methods of evaluation. 			
<i>Practical education: exercises, other forms of education, research related activities</i>			
Laboratory practice is following the above-mentioned lectures:			
<u>Gravimetry</u> Determination of dry matter content and water content in pharmaceutical preparations. Determination of ash residues in pharmaceutical preparations. Determination of iron by using a gravimetric method of precipitation.			
<u>Volumetry</u> Chelatometry – Determination of zinc, calcium and magnesium, and determination of water hardness. Argentometry – Determination of chlorides according to Mohr and Folhardt, determination of iodides according to Fajans. Acid-base titrations – Preparation and standardization of hydrochloric acid solution and sodium-hydroxide solution, determination of sodium-hydroxide, phosphorous acid and acetic acid, determination of temporary water hardness. Redox titrations – Permanganometry: preparation and standardization of potassium permanganate solution and determination of iron according to Zimmerman-Reinhart. Indirect iodimetric titrations –preparation and standardization of sodium-thiosulphate solution, determination of copper.			
Literature			
<i>Compulsory</i>			
<ol style="list-style-type: none"> Harvey D. Modern Analytical Chemistry. McGraw-Hill, Boston, 2000. Analytical chemistry laboratory manual (Internal script). 			
<i>Additional</i>			
1. Scoog DA, West DM, Holler FJ, Crouch SR. Fundamentals of Analytical chemistry. Brooks/Cole, Belmont, 2004.			
Number of active classes			Other:
Lectures: 30	Practice: 60	Other types of teaching:	
Teaching methods: lectures, laboratory exercises, consultations.			
Student activity assessment (maximally 100 points)			
Pre-exam activities	points	Final exam	points
Lectures		Written	
Practices	10	Oral	30
Colloquium	2 x 30		
Essay			