



<b>Study program:</b> Integrated Academic Studies in Pharmacy
<b>Course title:</b> Analytical Chemistry II
<b>Teacher:</b> Radomir V. Malbaša, Vesna B. Tepavčević, Nataša P. Milošević
<b>Course status:</b> Compulsory
<b>ECTS Credits:</b> 6
<b>Condition:</b> General chemistry
<b>Course aim</b> Acquiring theoretical and practical knowledge of classical quantitative chemical analysis, with emphasis on pharmaceuticals and other preparations relevant to the pharmaceutical profession.
<b>Expected outcome of the course:</b> Students learn how to apply analytical methods and sample preparation methods in quantitative chemical analysis. Laboratory practice in the identification of various compounds, in model and real systems. Sample preparation and application of <i>gravimetric and volumetric analyzes</i> .
<b>Course description</b> <i>Theoretical education</i> <ol style="list-style-type: none"> <li>1. 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.</li> <li>2. Gravimetry. Types of gravimetric analyses. Gravimetric precipitation methods. Gravimetric evaporation methods. Stoichiometric calculations in gravimetry.</li> <li>3. Volumetric analysis. Basics on the volumetric analysis. Conditions for applying the chemical reaction in 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.</li> <li>4. Acid-base titration. Application of acid-base titrations. Acidimetry. Alkalimetry. Titration curves. Potentiometric titration. Stoichiometric calculations.</li> <li>5. Precipitation titration. Conditions of applying the precipitation reaction in volumetry. Classification of precipitation titrations. Argentometry (classification, application, indicators). Stoichiometric calculations.</li> <li>6. Complexometric titrations. Definition. Role. <i>Titrations with inorganic</i> complexing agents. Examples. Chelatometry. Stoichiometric calculations.</li> <li>7. 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.</li> <li>8. Acid-base titrations in non-aqueous medium. Properties and classification of organic solvents according to their acid-base characteristics. Leveling and differentiating effects of solvents. Determination of acids and bases in non-aqueous mediums.</li> <li>9. Data processing of the results of quantitative analysis. Criteria associated with the quality of analytical results. Accuracy and precision. Evaluation of accuracy and precision. Errors in experimental measurements. Statistical methods of evaluation.</li> </ol> <i>Practical education:</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 Volhard, 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-thiosulfate solution, determination of copper.

**Literature**

*Compulsory*

1. Harvey D. Modern Analytical Chemistry. Boston: McGraw-Hill; 2000. (selected chapters)

*Additional*

1. Scoog DA, West DM, Holler FJ, Crouch SR. Fundamentals of Analytical Chemistry. Belmont: Brooks/Cole; 2004. (selected chapters)

**Number of active classes**

**Theory: 30**

**Practice: 60**

**Teaching methods**

Lectures, laboratory exercises, consultations.

**Student activity assessment** (maximally 100 points)

<b>Pre-exam activities</b>	<b>points</b>	<b>Final exam</b>	<b>points</b>
Lectures	5	Written	
Practices	15	Oral	30
Colloquium	2 ×25	.....	
Essay			