

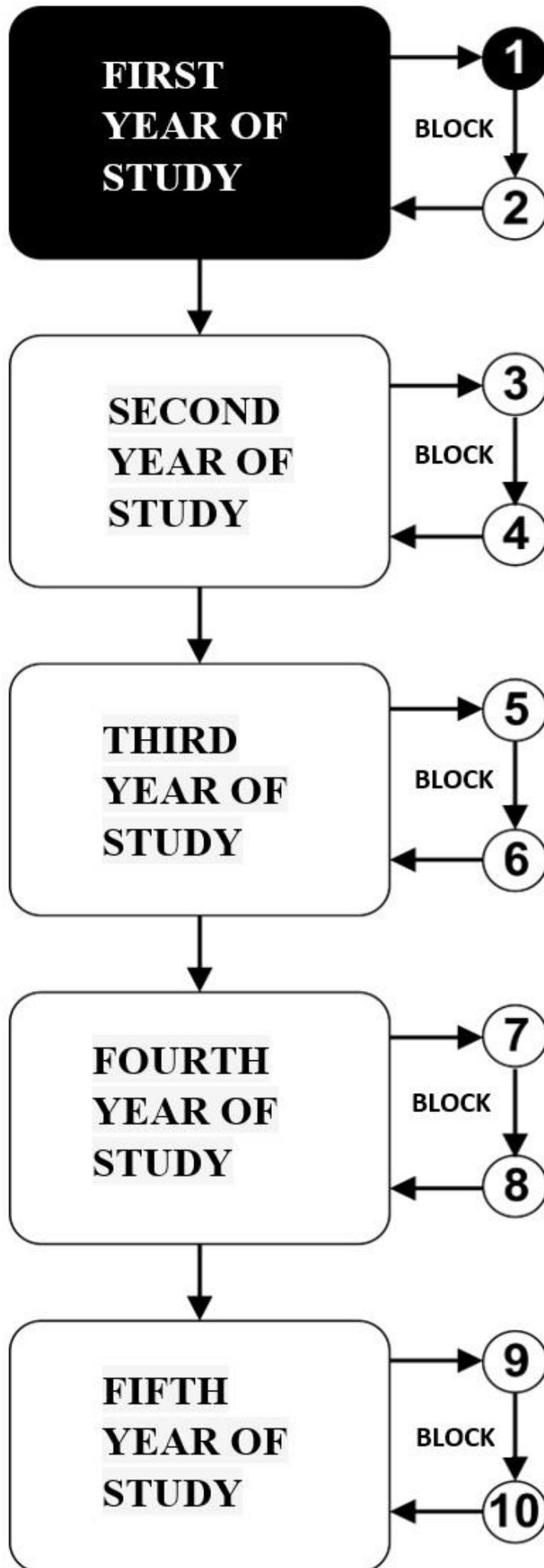


**INTEGRATED ACADEMIC
PHARMACY STUDIES**

FIRST YEAR OF STUDY

academic 2025/2026.

ANALYTICAL CHEMISTRY



Course:

ANALYTICAL CHEMISTRY

The course is evaluated with 8 ECTS. There are 6 hours of active teaching per week (4 hours of lectures and 2 hours of work in a small group).

TEACHERS AND ASSOCIATES:

	Име и презиме	Email address	title
1.	Snežana Jovanović Stević	snezanaj@kg.ac.rs	Assistant professor
2.	Mirjana Jakovljević	mirjana.tkb@gmail.com	Facilitator

COURSE STRUCTURE:

Module	Module name	Week	Lectures	Work in a small group	Teacher-supervisor module
1	Qualitative chemical analysis	7	4	2	Doc. Dr. Snežana Jovanović Stević
2	Quantitative chemical analysis	8	4	2	Doc. Dr. Snežana Jovanović Stević
					$\Sigma 60+30=90$

EVALUATION:

The student overcomes the course based on the points achieved in the pre-examination activities and the final test. The score is equivalent to the number of gained points (see tables). Points are earned as follows:

ACTIVITY DURING CLASSES: The student can gain up to 30 points by taking 2 exam question from that week, answering and receiving 0-2 points in accordance with the demonstrated knowledge.

FINAL EXAM: The student can gain up to 70 points

Module		MAXIMUM POINTS		
		Activity during classes	Final exam	Σ
1	Qualitative chemical analysis	14		14
2	Quantitative chemical analysis	16		16
	Final exam		70	70
Σ		30	70	100

The final grade is formed as follows:

In order to pass the course, student must gain a minimum of 51 points and pass all the modules.

To pass the module the student must:

1. Gain more than 50% of the points in that module
2. Gains more than 50% of the points provided for teaching activity in each module
3. Pass the module test, ie to have more than 50% correct answers.

NUMBER OF POINTS GAIN	MARK
0 - 50	5
51 – 60	6
61 – 70	7
71 – 80	8
81 – 90	9
91 - 100	10

TESTS BY MODULES

FINALE TEST

**FINALE TEST
0-70 POINTS**

EVALUATION OF FINAL TEST

The test has 35 questions
Each question is worth 2 points

THE PROGRAM:

FIRSTH MODULE: Qualitative methods of analysis

TEACHING UNIT 1 (FIRST WEEK):

INTRODUCTION TO ANALYTICAL CHEMISTRY AND ITS SIGNIFICANCE. THEORETICAL FUNDAMENTALS OF CHEMICAL METHODS OF ANALYSIS.

lectures 4 hours	work in a small group for 2 hours
Analytical chemistry Qualitative and quantitative analysis Division of analytical methods Significance and role of analytical chemistry Theoretical foundations of chemical methods Dissolution of substances (polar solvents, water and water dissolution, non-polar solvents)	Introduction to experimental work

TEACHING UNIT 2 (SECOND WEEK):

SOLUTIONS (CONCENTRATION AND ACTIVITY). CHEMICAL EQUILIBRIUM

lectures 4 hours	work in a small group for 2 hours
The composition of the solution Substance quantity and concentration Activity Chemical equilibrium (law of mass action, equilibrium constant, influence on equilibrium, conditional equilibrium constants)	Preparation of a solution of a specific concentration. Computational tasks

TEACHING UNIT 3 (THIRD WEEK):

ACID-BASE REACTIONS

lectures 4 hours	work in a small group for 2 hours
Acids and bases Reactions between acid and base Dissociation of acids and bases (solvent effect) pH, Hydrolysis, Buffers	

TEACHING UNIT 4 (FOURTH WEEK):

COMPLEX FORMATION REACTIONS. PRECIPITATION REACTIONS.

lectures 4 hours	work in a small group for 2 hours
Equilibria in solutions of complexes Complex stability constants Analytically significant complexes, Influence of side reactions Formations of complexes and nature of metal ions and ligands Precipitation reactions (solubility product, solubility of precipitates in pure water, Influence of common ion, Influence of different ions, Influence of side reactions on solubility, Precipitation and ion separation by controlling the concentration of the precipitating reagent)	

TEACHING UNIT 5 (FIFTH WEEK):

REDOX REACTIONS

lectures 4 hours	work in a small group for 2 hours
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Oxidation and reduction. Electrode potential.
Nernst's equation. Influence of solution acidity on electrode potential.
Standard electrode potential

TEACHING UNIT 6 (SIXTH WEEK):

QUALITATIVE CHEMICAL ANALYSIS

lectures 4 hours	work in a small group for 2 hours
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Complete and partial analysis
Elementary, functional and molecule analysis.
Phase analysis
Analytical reactions
Reagents and reagents
Separations and masking in qualitative analysis
Analysis of cations of the first and second groups

Confirmatory tests for the cations of the first and second analytical groups

TEACHING UNIT 7 (SEVENTH WEEK):

ANALYSIS OF CATIONS AND ANIONS

lectures 4 hours	work in a small group for 2 hours
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Analysis of cations of the third, fourth and fifth groups.
Anion analysis

Confirmatory tests for the cations of the third, fourth and fifth analytical groups. Confirmatory tests of anions

SECOND MODULE: Quantitative chemical analysis (volumetric methods of analysis, calculations in volumetry, acidimetry, alkalimetry, complexometry, precipitation titrations, oxidimetry and reductometry, gravimetric methods of analysis)

TEACHING UNIT 8 (EIGHTH WEEK):

QUANTITATIVE CHEMICAL ANALYSIS. VOLUMETRIC METHODS OF ANALYSIS

lectures 4 hours	work in a small group for 2 hours
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Division of volumetric methods of analysis
Conditions of chemical reactions
Equivalent and end point of titration
Changes in reactant concentration during titration.
Titration curves
Indicators in volumetric titration
Standard solutions in volumetry
Primary solutions
Volumetric determination techniques

Preparation of standard solution.
Calculations.

TEACHING UNIT 9 (NINTH WEEK):

CALCULATIONS IN VOLUMETRY

lectures 4 hours	work in a small group for 2 hours
Calculating the amount of a substance Calculation of the mass of the titrated substance and its mass fraction in the sample Calculation of solution concentration in standardization Dilution calculations Calculations at retitrations	Calculations in volumetry.

TEACHING UNIT 10 (TENTH WEEK):

ACIDYMETRY AND ALKALIMETRY

lectures 4 hours	work in a small group for 2 hours
Методе засноване на киселинско-базним реакцијама Титрација јаких киселина или јаких база Титрација слабих киселина или слабих база Титрације смесе киселина или база Титрације полипротичних киселина или база Примена киселобазних титрација	Кисело-базне титрације.

TEACHING UNIT 11 (ELEVENTH WEEK):

COMPLEXOMETRY

lectures 4 hours	work in a small group for 2 hours
Methods based on complex construction reactions EDTA as a chelating reagent The composition of the EDTA solution as a function of pH. Distribution diagram EDTA complexes with metals. Stability constants Titration curves Determination of finale point of titration (FPT) Metal indicators Application of complexometry	Complexometric titrations.

TEACHING UNIT 12 (TWELVE WEEK):

PRECIPITATION TITRATIONS

lectures 4 hours	work in a small group for 2 hours
Methods based on precipitation reactions Argentometry Other precipitation titrations Application of argentometric titrations	Precipitation titrations.

TEACHING UNIT 13 (THIRTEENTH WEEK):

OXIDIMETRY AND REDUCTOMETRY

lectures 4 hours	work in a small group for 2 hours
Methods based on redox reactions. Titration curves Redox indicators Division of redox method Permanganometry	Oxidimetry and reductometry.

TEACHING UNIT 14 (FOURTEENTH WEEK):

APPLICATION OF REDOX-TITRATION

lectures 4 hours	work in a small group for 2 hours
Cerimetry Dichromatometry Bromatometry Iodatometry Iodine titrations	Redox titrations.

TEACHING UNIT 15 (FIFTEENTH WEEK):

GRAVIMETRIC METHODS OF ANALYSIS

lectures 4 hours	work in a small group for 2 hours
Sedimentation and particle size of sediment Colloidal sediments Crystalline sediments Precipitation from homogeneous solutions Sediment aging Coprecipitation Deposition with corrector Filtration Sediment leaching Drying and annealing of sediments Water in solids Precipitation reagents Indirect gravimetric analysis Calculations in gravimetry	Some examples of gravimetric determinations. Calculations in gravimetry.

LECTURE SCHEDULE

MONDAY

PHARMACY PRACTICE ROOM 17

12.30-15.30

EXERCISE SCHEDULE

Friday

PHARMACY PRACTICE ROOM 17

08.00-09.30

[Schedule of lectures, practical classes and tests – academic calendar](#)

TEACHING SCHEDULE FOR THE COURSE ANALYTICAL CHEMISTRY

module	week	type	the name of the method unit	teacher
1	1	L	Introduction to analytical chemistry and its significance. Theoretical foundations of chemical methods of analysis.	Doc. Dr. Snežana Jovanović Stević
		P	Introduction to experimental work.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	2	L	Solutions (concentration and activity). Chemical equilibrium.	Doc. Dr. Snežana Jovanović Stević
		P	Preparation of a solution of a specific concentration. Computational tasks.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	3	L	Acid-base reactions	Doc. Dr. Snežana Jovanović Stević
		P	Acid-base reactions	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	4	L	Complex construction reactions. Precipitation reactions.	Doc. Dr. Snežana Jovanović Stević
		P	Complex construction reactions. Precipitation reactions.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	5	L	Redox reactions.	Doc. Dr. Snežana Jovanović Stević
		P	Redox reactions.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	6	L	Qualitative chemical analysis.	Doc. Dr. Snežana Jovanović Stević
		P	Confirmatory tests of cations of the first and second groups.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	7	L	Cation and anion analysis.	Doc. Dr. Snežana Jovanović Stević
		P	Confirmatory tests of cations of the third, fourth and fifth groups. Confirmatory tests of anions.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
			Final test of the first module	
2	8	L	Quantitative chemical analysis. Volumetric methods of analysis.	Doc. Dr. Snežana Jovanović Stević

TEACHING SCHEDULE FOR THE COURSE ANALYTICAL CHEMISTRY

module	week	type	the name of the method unit	teacher
		P	Preparation of standard solution. Calculations.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	9	L	Calculations in volumetry.	Doc. Dr. Snežana Jovanović Stević
		P	Calculations in volumetry.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	10	L	Acidimetry and alkalimetry.	Doc. Dr. Snežana Jovanović Stević
		P	Acid-base titrations.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	11	L	Complexometry.	Doc. Dr. Snežana Jovanović Stević
		P	Complexometric titrations.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	12	L	Precipitation titrations.	Doc. Dr. Snežana Jovanović Stević
		P	Precipitation titrations.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	13	L	Oxidimetry and reductometry.	Doc. Dr. Snežana Jovanović Stević
		P	Oxidimetry and reductometry.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	14	L	Application of redox titration.	Doc. Dr. Snežana Jovanović Stević
		P	Redox titrations.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević
	15	L	Gravimetric methods of analysis.	Doc. Dr. Snežana Jovanović Stević
		P	Some examples of gravimetric determinations. Calculations in gravimetry.	Mirjana Jakovljević Doc. Dr. Snežana Jovanović Stević

TEACHING SCHEDULE FOR THE COURSE ANALYTICAL CHEMISTRY

module	week	type	the name of the method unit	teacher
			Final test of the second module	
			Final exam	