DESCRIPTION OF THE COURSE OF STUDY

Course code	**0531.6.CHEM1.B/C.CA**	
Name of the course in	Polish	***Chemia analityczna***
	English	***Analytical chemistry***

1. LOCATION OF THE COURSE OF STUDY WITHIN THE SYSTEM OF STUDIES

1.1. Field of study	Chemistry
1.2. Mode of study	Full-time studies
1.3. Level of study	First-cycle studies
1.4. Profile of study*	General academic
1.5. Person/s preparing the course description	dr Agata Skorupa, dr Magdalena Jakubczyk
1.6. Contact	agata.skorupa@ujk.edu.pl, magdalena.jakubczyk@ujk.edu.pl

2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

2.1. Language of instruction	English/Polish
2.2. Prerequisites*	Fundamentals of Chemistry

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Form of classes		L-30 hours, S-20 hours, L-75 hours
3.2. Place of classes		Teaching rooms of the Institute of Chemistry of UJK
3.3. Form of assessment		Examination, pass with grade (seminar, laboratory)
3.4. Teaching methods		Lecture – delivery methods: description, informative lecture, talk Seminar – practical methods: subject exercises Laboratory – practical methods: laboratory exercises, demonstration with explanation
3.5. Bibliography	**Required reading**	1. D. A. Skoog, D. M. West, F. J. Holler, S. R. Crouch, *Fundamentals of Analytical Chemistry*, 9th Ed., Brooks/Cole 2004. 2. T. Lipiec, Z.S. Szmal, *Chemia analityczna z elementami analizy instrumentalnej.* Wyd. Lekarskie PZWL. Warszawa 1996. 3. J. Minczewski, Z. Marczenko, *Chemia analityczna*, t. I i II. Wyd. Naukowe PWN. Warszawa 2012. 4. A. Cygański, *Chemiczne metody analizy ilościowej.* Wyd. Naukowo-Techniczne. Warszawa 2012. 5. Z. Galus (red.). *Ćwiczenia rachunkowe z chemii analitycznej*, Wyd. Naukowe PWN. Warszawa 2000.
	Further reading	R. Kocjan (red.). Chemia analityczna, t. I*: Analiza jakościowa. Analiza ilościowa.* Wyd. lekarskie PZWL. Warszawa 2002.

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

4.1. Course objectives ***(including form of classes)***

1. Lecture.

C1. Acquaintance with the theoretical basis of classical methods of qualitative and quantitative chemical analysis.
C2. Presentation of criteria for the division of chemical methods of qualitative and quantitative (volume) analysis.
C3. Preparation for practical solving of problems related to calculations in analytical chemistry.

2. Seminar.

C1. Acquaintance with the principles of chemical calculations in analytical chemistry related to: converting concentrations, preparing solutions of specific concentration and pH.

3. Laboratory.

C1. Acquaintance with practical activities related to the identification of cations and anions.
C2. Acquaintance with volumetric quantitative analysis of acids, bases (acid-base titrations) and metal cations (complexation titrations).
C3. Developing skills in the correct selection of reagents, organizing the workplace, preparing glass and keeping it clean.
C4. Developing an attitude of conscious performance of activities, based on the acquired knowledge, sensitizing the need to maintain safety when performing laboratory activities, saving reagents, electricity, water and gas, making people aware of the dangers threatening the natural environment related to performing laboratory activities.

4.2. Detailed syllabus ***(including form of classes)***

Lecture

1. Characteristics of analytical chemistry and chemical analysis: goals, tasks, division. Aqueous solution and chemical equilibria. Effect of electrolytes on chemical equilibria. Classifying solutions of electrolytes. Acid/base dissociation constants. Ionic strength. Activity coefficients. A theory of acid/base. The Brönsted-Lowry theory. Conjugate acids and bases. Autoprotolysis, amphiprotic substance. Dissociation of water. pH of Solutions of strong and weak acids, bases. Buffer solutions. Buffer capacity. The Henderson-Hasselbalch equation. pH of buffer solutions. The formation of complexes. Formation constants and conditional formation constants. Application of complexation reactions in chemical analysis. Precipitation reactions. Solubility-product constants. Oxidation/reduction reactions. Basic concepts: oxidant, reductant, oxidation, reduction. The Nernst equation. Direction and equilibrium of redox reactions. The effect of pH, complexation and precipitation reactions on the redox potential. Chemical qualitative analysis. Division of cations and anions into analytical groups. Group reactions and characteristic reactions. The use of organic reagents for the identification of ions. Classical methods of analysis. Titrations in analytical chemistry. Standard solution and primary, secondary standards. Acid/base titrations. Types of titration curves. Equivalence points and end points. Titration error. Titration polyfunctional acids and bases. Acid/base indicators. Complexation reactions and titrations. Ethylenediaminetetraacetic Acid (EDTA). Reagents for EDTA titrations, EDTA titration curves. Titration methods involving EDTA.

Seminar

1. Solutions and their concentrations. Equilibrium calculations using activity coefficients. Calculation the ionic strength, activity coefficient, and activity of the species in solution. Calculation of degrees and dissociation constants of acids and bases. The solubility and solubility-product constants. The effect of a common ion, ionic strength, pH and complexing agents on the solubility of a precipitate. Calculation the hydronium ion concentration (pH) of solutions of weak acids, bases, and buffer solutions. Oxidation/reduction reactions. The Nernst equation. Direction and equilibrium of redox reactions. The effect of pH, complexation and precipitation reactions on the redox potential.

Laboratory

1. Qualitative analysis of cations of groups I – V (simple samples and mixtures). Qualitative analysis of anions of groups I – VI (simple samples). Quantitative analysis. Calibration of measuring vessels. Acid-base titrations: preparation and titration of HCl solution, determination of NaOH, preparation and titration of NaOH solution, determination of acetic acid. Complexation titrations: Preparation and titration of EDTA solution, determination of Ni(II).

4.3 Intended learning outcomes

Code	A student, who passed the course	Relation to learning outcomes
within the scope of **KNOWLEDGE:**		
W01	Knows the concepts and chemical laws related to equilibria in solutions: acid-base, complexation, oxidation and reduction, and precipitation of sediments.	CHEM1A_W01 CHEM1A_W06
W02	Knows the principles of dividing cations and anions into analytical groups and the characteristic reactions of selected ions.	CHEM1A_W06
W03	Knows the methods of expressing the concentration of solutions, the theoretical basis of quantitative chemical analysis and the principle of selection and operation of visual indicators, explains the course of chemical reactions, describes the course of acid-base and complexation titration curves	CHEM1A_W06
within the scope of **ABILITIES:**		
U01	Is able to independently carry out basic qualitative and quantitative chemical analyses	CHEM1A_U01 CHEM1A_U02
U02	Is able to make observations, analyze and interpret the results of experiments and describe their course using chemical reaction equations	CHEM1A_U01 CHEM1A_U02
U03	Is able to plan work in a team and learn and organize his own work	CHEM1A_U13 CHEM1A_U14
within the scope of **SOCIAL COMPETENCE:**		
K01	Is aware of the need to save reagents, electricity, water and gas and the adverse impact of pollution on the natural environment and human health	CHEM1A_K02

4.4. Methods of assessment of the intended learning outcomes

Teaching outcomes *(code)*	Method of assessment (+/-)														
	Exam oral / written*			Test*			Activity in classes*			Group work*			Others* Written reports		
	Form of classes			*Form of classes*			*Form of classes*			*Form of classes*			*Form of classes*		
	L	*S*	*Lab*	*L*	*S*	*Lab*	*L*	*S*	*Lab*	*L*	*S*	*Lab*	*L*	*S*	*Lab*
W01	+				+	+			+						+
W02	+					+			+						+
W03	+				+	+		+	+						+
U01									+						

U02									+						+
U03									+			+			
K01									+						

delete as appropriate

4.5. Criteria of assessment of the intended learning outcomes		
Form of classes	**Grade**	**Criterion of assessment**
Lecture (L) * (including e-learning)	**3**	55-64% points possible to obtain in the field of knowledge
	3,5	65-73% points possible to obtain in the field of knowledge
	4	74-82% points possible to obtain in the field of knowledge
	4,5	83-91%points possible to obtain in the field of knowledge
	5	92-100% points possible to obtain in the field of knowledge
Seminar (S) * including e-learning(including e-learning)	**3**	55-64% points possible to obtain in tests
	3,5	65-73% points possible to obtain in tests
	4	74-82% points possible to obtain in tests
	4,5	83-91%points possible to obtain in tests
	5	92-100% points possible to obtain in tests
Laboratory (Lab)* (including e-learning)	**3**	55-64% points possible to obtain in the field of knowledge, skills and competences
	3,5	65-73% points possible to obtain in the field of knowledge, skills and competences
	4	74-82% points possible to obtain in the field of knowledge, skills and competences
	4,5	83-91%points possible to obtain in the field of knowledge, skills and competences
	5	92-100% points possible to obtain in the field of knowledge, skills and competences

5. BALANCE OF ECTS CREDITS – STUDENT'S WORK INPUT

Category	**Student's workload**	
	Full-time studies	**Extramural studies**
NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER /CONTACT HOURS/	**125**	**85**
*Participation in lectures**	30	20
*Participation in classes, seminars, laboratories**	95	65
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	**125**	**165**
*Preparation for the classes, seminars, laboratories**	85	110
*Preparation for the exam/test**	30	48
Others (Written reports)*	10	7
TOTAL NUMBER OF HOURS	**250**	**250**
ECTS credits for the course of study	**10**	**10**

delete as appropriate

Accepted for execution *(date and legible signatures of the teachers running the course in the given academic year)*

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