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<tr><td>NAME OF THE COURSE</td><td colspan="5">Analytical chemistry I</td></tr>
<tr><td>Code</td><td>PMC101</td><td>Year of study</td><td colspan="3">2.</td></tr>
<tr><td>Course teacher</td><td>Ivana Mitar, assistant professor</td><td>Credits (ECTS)</td><td colspan="3">4.0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>30</td><td>15</td><td></td><td></td></tr>
<tr><td>Status of the course</td><td>mandatory</td><td>Percentage of application of e-learning</td><td colspan="3">10 %</td></tr>
<tr><td colspan="6">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="5">Understanding of basic principles and application of classical methods of qualitative and quantitative analysis of substances and basic instrumental methods.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="5">Completed course General Chemistry I and II.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="5">The student will be qualified to:
1. define the basic concepts of analytical chemistry, quantitative and qualitative analysis,
2. explain the physical and chemical principles of each method of classical analysis,
3. participate in the selection of the appropriate analytical method depending on the nature of the sample to be analyzed,
4. understand acid-base, complex, precipitation, redox reactions and
5. understand the calculation, explanation, and interpretation of analytical results.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">LECTURES:

1. Definition, meaning and classification of analytical chemistry
Meaning and development of analytical chemistry; analytical procedure (problem definition, sampling, selection of analytical methods, analytical signal, report); analytical data processing (range, mean, median, precision, standard deviation).
Basic parameters of analytical process quality (sensitivity, precision, accuracy, LDP, LOQ, LOD, selectivity); errors in analysis (types, corrections); safety of laboratory work; classification of analytical chemistry, chemical analysis (qualitative and quantitative); physical methods of analysis; instrumental methods of analysis.
2. Heterogeneous and homogeneous systems
Chemical equilibrium (equilibrium constants: thermodynamic, concentration, conditional); quantitative behavior.
3. Acid-base equilibria
Acid and base strength (α-value); autoprotolysis of water.
4. Activity and activity coefficient
Ionic strength of the solution.
5. Acid-base buffer
Buffer preparation; buffer capacity.
6. Salt hydrolysis
Acidity and basicity of salts; hydrolysis constant.</td></tr>
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<tr><td></td><td colspan="6">7. Quantitative chemical analysis: titrimetric methods of analysis
Titration, equivalence point, end point; primary and secondary standards; standardization of solutions; indicators; titration curves.
8. Acid-base titrations
Primary and secondary acid-base titration standards; acid-base indicators; titration curves (calculation of pH during titration).
9. Equilibria of complex formation
Individual and sum constants of stability of complexation; ligands, coordination number metal; α-values in complex equilibria.
10. Complexometric titrations
EDTA, Y^{4-} pH dependence; complexometric indicators; titration curves (calculation of pM in titration); influence of other complexing species (auxiliary ligands) on the reaction of metal ions with EDTA
11. Equilibrium between a solid, poorly soluble substance and its ions
Precipitation and dissolution reactions (solubility, solubility product constant); influence of ionic strength, common ion, foreign ion, and parallel reactions on solubility; conditional solubility product constant.
12. Titrations based on precipitation equilibria
Indicators in precipitation titrations; prediction of titration curves.
13. Quantitative chemical analysis: gravimetric methods
Properties of precipitation reagents (specific, selective, organic, inorganic), types of precipitate; gravimetric factor.
14. Oxidation-reduction equilibria
Standard electrode potential; electrode potential; Nernst equation; equilibrium constants of oxidation-reduction reactions.
15. Titrations based on reduction-oxidation equilibria
Primary and secondary standards for redox titrations; indicators in redox titrations; titration curves.

SEMINARS: Solving numerical examples related to the theoretical material covered.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures
x seminars and workshops
☐ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☐ independent assignments
☐ multimedia
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Students are required to attend classes (lectures and seminars 80 %) and actively participate in the teaching process. That will be recorded and evaluated in making a final assessment.</td></tr>
<tr><td rowspan="4">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical training</td><td>1</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1</td><td>(Other)</td><td></td></tr>
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	Written exam	1.5	Project		(Other)	

Grading and evaluating student work in class and at the final exam	The final grade for the course will consist of a written (seminar) and an oral part (lecture). The written part may be taken in whole or in part by partial examinations during the semester. The exams will be graded as follows: more than 60 % - adequate, more than 70 % - good, more than 80 % - very good and more than 90 % - excellent. The oral part of the examination is taken by the students after successfully passing the written examination (partially or completely).

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	1. D. A. Skoog, D. M. West, F. J. Holler and S. R. Crouch, Fundamentals of Analytical Chemistry, 9th Edition, Thompson Brooks/Cole, Belmont, USA, 2014.	10	

Optional literature (at the time of submission of study programme proposal)	1. R. Kellner, J. M. Mermet, M. Otto, M. Valcarcel and H. M. Widmer, Analytical Chemistry (A Modern Approach to Analytical Science, Second Edition), Wiley-VCH Verlag, Gmbh & Co. KGaA, Weinheim, 2004. 2. D. C. Harris, Quantitative Chemical Analysis, W. H. Freeman and Company, 41 Madison Avenue New York, NY, 2016. 3. B. M. Tissue, Basic of Analytical Chemistry and Chemical Equilibria, John Wiley & Sons, Inc., Hoboken, New Jersey, NY, 2013. 4. G. D. Christian, P. K. Dasgupta, K. A. Schug, Analytical Chemistry, John Wiley & Sons, Inc., 111 River Street, Hoboken, New Jersey, NY, 2014.
Quality assurance methods that ensure the acquisition of exit competences	Quality of the teaching and learning, monitored at the level of the (1) teachers, accepting suggestions of students and colleagues, and (2) faculty, conducting surveys of students on teaching quality.
Other (as the proposer wishes to add)	