

Faculty of Mathematics and Natural Sciences – winter semester

Name of subject	Field of study	Form of classes	ECTS points	Short summary
Chemical and Physical Methods of Environmental Examination	Environmental Protection	Laboratory classes Auditorium classes	2 1	Students get information and prepare important concepts used in environmental physicochemical measurements, learn to communicate using specialized terms, including English nomenclature. Students practically learn the techniques of instrumental analysis and sampling technics. They use statistical methods to estimate the uncertainty of the results. They find the causes of random and systematic errors in the used methods, and they are able to choose the optimal method for a typical analytical purpose.
Analytical Chemistry I (S&N)	Chemistry	Lecture Auditorium classes	1 1	Lecture: basic terms of analytical chemistry; sampling; separation and pre-concentration methods; different types of chemical reactions applied in analytical chemistry Exercises: basic calculations; evaluation of uncertainties; tests for outlying results Laboratory: Introduction to gravimetric and volumetric methods; preparation of standard solutions
Analytical Chemistry II (S&N)	Chemistry	Laboratory classes	4	Subsequent fields of classical chemical analysis: gravimetric methods; volumetric methods (acid-base; complexometric, redox and precipitation titration); Volumetric analysis: iodometric, acid-base and complexometric titration
Physical Chemistry	Chemistry	Lecture Auditorium	2 1	Principles and applications of thermodynamics in chemistry. The heat of reaction. Hess's and Kirchoff's

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(S&N)		classes		<p>principles. The thermodynamics functions. Chemical potential and its dependence of p and T. Activity and coefficient of activity. Equilibrium constants of a chemical reaction. Phase Transitions. Clausius-Clapeyron equation. The Gibbs phase rule. The Raoult's and Henry's principles. Kinetics of simple and complex chemical reactions. Theories of reaction rate. The elements of catalysis.</p> <p>Liquids: density, viscosity and surface tension. Physicochemical properties of surface and colloids. Basics of electrochemistry: conductivity, electrodes, cells. Introduction to spectroscopy: interaction of the electromagnetic wave with a matter, absorption, emission. The fundamentals of spectroscopy. The elements of quantum chemistry and the examples of its practical application.</p>
Analytical Instrumental Methods (S&N)	Chemistry	Laboratory classes	4	Basic principles and applications of analytical instrumental methods (spectroscopic, electroanalytical and chromatographic)
Organic Chemistry (S)	Chemistry	Laboratory classes	4	<p>The student has knowledge of the basics of organic chemistry including both hydrocarbons and its derivatives. In particular student knows: -criteria for classification of organic compounds jointly with naming rules, -physical properties and chemical reactivity of the most important groups of organic compounds, -types and mechanisms of organic reactions.</p> <p>Basics of lab safety procedures; basics operations and equipment in organic chemistry; synthesis and analysis of organic compounds</p>

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Atomic Spectrometry in Industrial Samples Analysis (S&N)	Chemistry	Laboratory classes	1	Methods for samples digestion; determination of trace metals by means of atomic absorption spectrometry; data evaluation
Statistics and Chemometrics for Analytical Chemistry (S&N)	Chemistry	Lecture IT Laboratory Auditorium classes	2 1 1	Theoretical basics of chemometric methods applied for multi-dimensional data analysis. Mastering the tools used for chemometric analysis to a sufficient degree to ensure independent design and analysis of other measurement data.
Introduction to Molecular Modelling with the Use of Quantum Chemistry Methods (S)	Chemistry	IT Laboratory	3	Basic information on software used for molecular modelling with quantum chemistry methods and its applications for solving basic chemical problems
Methods of Samples Preparation for Analytical Purposes (S)	Chemistry	Lecture Laboratory classes	1 1	Methods for samples digestion (dry and wet techniques; different heating methods); purification methods; trace preconcentration
The Mathematics of Property Insurance	Mathematics	Lecture IT Laboratory	1 2	Individual Risk Model. Cumulative Risk Model. Introduction to the theory of ruin.
Algorithmic Mathematics	Mathematics	Lecture IT Laboratory	1 2	Basics in some programming language. Analysis and implementation of some algorithms with their applications in mathematics.

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Special Functions in Applications	Mathematics	Lecture IT Laboratory	1 2	Applications of selected classes of special functions (Euler gamma and beta functions, orthogonal polynomials, Bessel functions) in selected issues of natural and technical sciences.