Course descriptions

TABLE OF CONTENTS

COURSE DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.KAlCh/N-mCAL_150/25	**Course title:** Advanced Chemometrics

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): The evaluation of the subject includes the verification of knowledge from seminars and lectures, for a maximum of 100 points. The seminar (maximum number of 40 points) includes the development and presentation of a seminar paper. The lecture (maximum number of 60 points) includes a final written test. The final grade includes the assessment from the final written test and the seminar. A total of at least 92 points is required to obtain an A grade, at least 84 points to obtain a B grade, at least 76 points for a C grade, at least 68 points for a D grade, and at least 60 points for an E grade. The evaluation is identical even for the distance form of education.

Learning outcomes:
Aims and Objectives:
Students will become familiar with information about the status of chemometrics in classical and new natural science and technical fields, and its essential need in obtaining relevant information from experimentally measured data. Statistical data analysis occupies an increasingly important position not only in analytical chemistry. Obtaining relevant information from the measured data, assessing the quality of the obtained data and choosing a suitable statistical model and its verification fundamentally affects the analytical procedure and the choice of the used analytical method. The content of the subject is focused on statistical planning and optimization of experiments, analysis of dispersion, processing of chemical literature and use of PC in processing chemical information. After completing the course, students will be able to correctly process and evaluate experimentally obtained data using computer applications.

Class syllabus:
Syllabus/Indicative Content:
1. Chemical literature with a focus on analytical chemistry, chemical information processing strategy, primary sources of information. Types of research, method of storing and sorting information, secondary sources of information. Reference Manager. Chemical information on the Internet, computer processing of information. Databases needed for analytical chemistry, CCOD, WOS, ChemSpider and others.
2. Basic statistical concepts, numerical characteristics and statistical planning of experiments.

3. Probability distributions, Limit of proof and limit of determination. Uncertainty of analytical measurement.
4. Selectivity, sensitivity. A straight line and its applications in chemistry (calibration curve). Linearization of calibration curves.
5. Logarithms - applications in chemistry (thermodynamic equations, kinetic equations, light absorption).
6. Exponential - mathematical description and applications in chemistry (spectroscopy, kinetics, thermodynamics). Hyperbola - applications in chemistry (analyte-receptor interaction).
7. Applications of differential and integral calculus in analytical chemistry.
8. Linear and non-linear fitting in the Origin program.
9. Nonlinear fits in the Mathematica program (1:1 analyte-receptor complex, preferential solvation).
10. Fitting data in the presence of noise. Time data analysis, step selection, smoothing using FFT.
11. Analysis of variance (ANOVA).
12. Optimization of trials, SIMPLEX.
13. Application of statistical planning, ANOVA and optimization procedures in solving analytical problems using CHEMSTAT and EXCEL programs.

Recommended literature:
Suggested readings:
Current monographic and magazine literature and Internet information resources. Original and review articles from professional magazines.
J.N. Miller, J.C. Miller: Statistics and Chemometrics for Analytical Chemistry, Pearson Prentice Hall, 4th ed. 2000.

Languages necessary to complete the course:
English

Notes:
course offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Andrea Vojs Staňová, PhD., doc. Ing. Roman Szücs, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-195/25	Advanced analytical laboratory (1)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The subject is evaluated based on the submission of a report on the specified project topic. The resulting evaluation takes into account the level of the submitted report and the student's approach to obtaining and processing experimental results, for a maximum of 100 points. It is necessary to get at least 92 points to get an A grade (excellent work), to get a B grade at least 84 points (above average work), to get a C grade at least 76 points (ordinary reliable work), to get a D grade at least 68 points (acceptable results) and for grade E at least 60 points (results meeting the minimum criteria). A student who does not meet the minimum criteria will receive an Fx rating.

Learning outcomes:
Aims and Objectives:
The student conducts research on a given topic and learns to obtain his own experimental data using a specific analytical method, which he subsequently interprets under the professional supervision of the teacher.

Class syllabus:
Syllabus/Indicative Content:
• Working with literary sources and carrying out experiments under the expert guidance of pedagogical and scientific staff on a specifically assigned topic. Theoretical and practical preparation for the diploma thesis.

Recommended literature:
Suggested readings:
Selected chapters from monographs and publications in scientific journals according to the focus of the project.

Languages necessary to complete the course:
English

Notes:
course offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Andrea Vojs Staňová, PhD., prof. RNDr. Marian Masár, PhD., doc. RNDr. Radoslav Halko, PhD., Mgr. Jasna Hradski, PhD., doc. Ing. Roman Szücs, PhD., RNDr. Peter Troška, PhD., prof. PharmDr. Josef Jampílek, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-196/25	Advanced analytical laboratory (2)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The subject is evaluated based on the submission of a report on the specified project topic. The resulting evaluation takes into account the level of the submitted report and the student's approach to obtaining and processing experimental results, for a maximum of 100 points. It is necessary to get at least 92 points to get an A grade (excellent work), to get a B grade at least 84 points (above average work), to get a C grade at least 76 points (ordinary reliable work), to get a D grade at least 68 points (acceptable results) and for grade E at least 60 points (results meeting the minimum criteria). A student who does not meet the minimum criteria will receive an Fx rating.

Learning outcomes:
Aims and Objectives:
The student conducts research on a given topic and learns to obtain his own experimental data using a specific analytical method, which he subsequently interprets under the professional supervision of the teacher.

Class syllabus:
Syllabus/Indicative Content:
• Working with literary sources and carrying out experiments under the expert guidance of pedagogical and scientific staff on a specifically assigned topic. Theoretical and practical preparation for the diploma thesis.

Recommended literature:
Suggested readings:
Selected chapters from monographs and publications in scientific journals according to the focus of the project.

Languages necessary to complete the course:
English

Notes:
course offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Andrea Vojs Staňová, PhD., prof. RNDr. Marian Masár, PhD., doc. RNDr. Radoslav Halko, PhD., Mgr. Jasna Hradski, PhD., doc. Ing. Roman Szücs, PhD., RNDr. Peter Troška, PhD., prof. PharmDr. Josef Jampílek, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAgCh/N-mCAG-160/25	Advanced bioinorganic chemistry

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): Grades will be based on the results of two written tests and final exam. More than 50% of points must be obtained from each part of the grading. To obtain a total A rating it is necessary to obtain on average at least 90% of points, to obtain a B rating at least 80% points, to a C rating at least 70% points, to a D rating at least 60% points and to an E rating at least 50% points. Credits will not be awarded to a student who scores less than 50% of the points.

Learning outcomes:
Aims and Objectives:
The topics of this course are advanced concepts of bioinorganic chemistry. Students will learn principles of chemical interactions in living systems and essential roles of metals in biology. Coordination bonds between transition metals and various types of biologically relevant ligands will be studied in molecular detail. Further, participants will expand their knowledge in the uptake, transport, storage and homeostasis of essential trace elements for all living cells. The formation of certain reactive molecules within metabolism possessing toxicity will be discussed together with their efficient removal by specific antioxidant enzymes. Particular emphasis will be given on potential applications of coordination compounds in medicinal chemistry and environmental biotechnology. Also, the design of artifical metalloenzymes and non-classical photosyntesis will be given a place.

Class syllabus:
Syllabus/Indicative Content:
Introduction, scientific framework, interdisciplinarity and advanced concepts of biological inorganic chemistry. Types of chemical interactions between various biomolecules. Formation of coordination bonds for transient metals and main types of ligands in biological systems. HSAB theory, hard and soft ligands and central ions, chelating effects, chelate therapy and the typical geometries of chelating complexes. Uptake, transport and storage of iron in living organisms. Fenton reactions and their danger for the homeostasis and components of cells. Diversity and functions of heme proteins. Catalases, peroxidases, peroxygenases, oxidases, cytochromes P450 and their involvement and function in metabolism. Occurrence, uptake and storage of copper in living organisms. Diversity of Cu-proteins and their different oxidation

states. Cobalt and its essentiality for living organisms. Nanoparticles containing diverse metal ions and their applications. Nickel, chromium and molybdenum – their occurrence in biosphere and diversity of enzymes involved. Metals involved in activity of hydrogenases and catalytic splitting of hydrogen. Importance of vanadium and manganese for active centers of selected proteins. Diversity and functions of superoxide dismutases. Zinc its availability, uptake and involvement in functions of essential enzymes. Zinc transporters in the cells. Interaction of zinc ions with DNA macromolecules. Magnesium and its significance for all living organisms. Importance of magnesium for photosynthesis, various proteins containing magnesium. Availability and essentiality of calcium for diverse organisms. Biological minerals with calcium and proteins containing calcium ions. Biological chemistry of iodine. Availability, uptake and storage of iodine for various organisms. Thyroid hormones and essential metabolic functions based on their reactivity. Design of artificial metalloenzymes and nanozymes for advanced biotechnologies in eco-compatible conditions. Principles and applications of non-classical photosynthesis.

Recommended literature:

Suggested readings:

Donald Voet, Judith G. Voet: Biochemistry 4th Edition New Jersey, Wiley 2011

Wolfgang Kaim, Brigitte Schwederski, Axel Klein: Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life: An Introduction and Guide. Wiesbaden, Wiley 2013.

Ivano Bertini, Harry B. Gray, Stephen J. Lippard, Joan Selverstone Valentine: Bioinorganic Chemistry Libretexts Davis California 2020 available online

Robert Crichton: Biological Inorganic Chemistry – A New Introduction to Molecular Structure and Function 3rd Edition London, Academic Press 2019

Languages necessary to complete the course:

English

Notes:

offered in winter semester only

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: RNDr. Marcel Zámocký, DrSc.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.LPM/N-mCXX-011/25	Advanced characterization methods

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Each lecture will contain multiple discussion sections of the covered topics. Participation in the problem-solving during seminars will represent 20% of the grade. During the semester, students will have multiple homework assignments on topics covered in the lectures. The homework will represent 30% of the grade. At the end of the semester, students will take the final exam covering all topics. The grade for the final exam will represent 50% of the final grade. Overall grading: A> 90> B> 80> C> 70> D> 60> E> 50> FX

Learning outcomes:
Students will gain deeper understanding of experimental methods commonly used in structural and electronic characterization of atoms, molecules and crystalline solids. Each experimental technique will be discussed from the instrumental as well as application prospective. During the seminars, students will solve specific chemical problems and will have the opportunity to see how the various characterization instrumentation is operated.

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 1

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: RNDr. Milan Sýkora, PhD., MBA

Last change: 15.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCXX-001/25	Advanced laboratory

Educational activities:
Type of activities: practicals
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
The final grade consists of two parts – student's own work on practical tasks (40%) and protocols with the reports on experimental tasks (60%) At least 50% from protocols has to be obtained to pass the course.
Grade scale: A 92%-100%, B 84%-91%, C 76%-83%, D 68%-75%, E 61%-67%, Fx 60% and less.

Learning outcomes:
Students will hone their experimental skills in practical settings from various fields, to ease their transition into the research laboratories. They will gain hands-on experience with state-of-the art equipment, used in the various sub-specializations of this study program. Students will be capable of designing, performing and evaluating their own experiments. Eventually, they will be able to use these practical skills in the work on their diploma thesis.

Class syllabus:
1. Organic photochemical transformations in practice – fluorescence quenching, reaction quantum yield determination
2. Enzymatic enantioselective reactions, determination of enantioselectivity by HPLC
3. GC-MS in structural elucidation and GC-FID with internal standard as a tool for determination of yields and the application of 19F NMR in yield determination.
4. Work in air- and moisture- free environments: operation of a glovebox, Schlenk technique
5. High temperature synthesis and synthesis of nanomaterials.
6. Determination of electrochemical parameters by cyclic voltammetry, Randles–Ševčík behavior, catalytic current.
7. Thermodynamics of micellization: techniques of advanced data evaluation
8. Capillary electrophoresis: determination of natural ionogenic compounds in water

Recommended literature:
Advanced Organic Synthesis: A Laboratory Manual, D. V. Liskin,, P. Chaloner, ‎CRC Press, 2015
The Manipulation of Air-Sensitive Compounds, D. F. Shriver, M. A. Drezdzon, Wiley, 1986

Languages necessary to complete the course:
English

Notes:
offered in winter semester only

Past grade distribution
Total number of evaluated students: 1

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Ing. Michal Májek, PhD.

Last change: 15.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAgCh/N-mCAG-161/25	Advanced main group chemistry and applications

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 1 **per level/semester:** 13 / 13
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): Seminars are evaluated at the end of the semester. From 100 pts that the student can get during the overall evaluation, a maximum of 50 pts is from the seminar evaluation where the student will prepare a seminar work along with a final short presentation on a selected topic. The seminar topics will be introduced by the lecturer during the first 2 weeks of the semester and one topic will be assigned to each student. The student will submit the seminar work no later than the last day of the teaching part of the semester. The submission of the seminar work is a condition to take the written examination. The written examination will be based on the content of lectures and the student can obtain a maximum of 50 pts.
The final grade is determined according to the following scale: A - at least 92 points, B - at least 84 points, C - at least 76 points, D - at least 68 points, E - at least 60 points.

Learning outcomes:
Aims and Objectives:
By completing the course, the students gain a comprehensive overview of the properties of main group elements and their compounds. Advanced topics in s and p block chemistry will be introduced, such as low coordinate main group element centres, base stabilised low valent main group compounds, hypervalent bonding, non-classical (3-center 2-electron, 3-center 4-electron, 4-center 2-electron) bonds, frustrated Lewis pairs and weakly coordinating anions. Students should recognise the importance of ligand properties and steric protection in the synthesis of low coordinate main group compounds including multiply bonded systems, to know the implications for their reactivity, understand the link between structure and bonding of various main group compound classes and their reactivity, including small molecule activation. The focus of the subject is mainly on technologically important non-transitional elements, their chemical and electrochemical production, practical use in materials and the latest knowledge in the chemistry and reactivity of their compounds. After successful completion of the subject, the student should have a comprehensive overview of the occurrence, electronic structure and applications of compounds of these elements, especially from the perspective of modern materials and technologies (such as fuel cells, semiconductors, batteries), industry, catalysis and biomedical applications.

Class syllabus:

Syllabus/Indicative Content:
1. Introduction to the advanced main group chemistry, electronic structure, bonding, reactivity.
2. Hydrogen, its production, hydrogen as a fuel, hydrogen intercalated compounds.
3. Inorganic and organometallic chemistry of alkali metals (Li, Na, K, Rb, Cs; structure, bonding, reactivity, properties, use in industry, materials, applications).
4. Inorganic and organometallic chemistry of alkali earth metals (Be, Mg, Ca, Sr, Ba, Ra; structure, bonding, reactivity, properties, use in industry, materials, applications).
5. Inorganic and organometallic chemistry of group 13 elements (B, Al, Ga, In, Tl; structure, bonding, reactivity, properties, use in industry, materials, applications).
6. Inorganic and organometallic chemistry of group 14 elements (C, Si, Ge, Sn, Pb; structure, bonding, reactivity, properties, use in industry, materials, applications).
7. Inorganic and organometallic chemistry of group 15 elements (N, P, As, Sb, Bi; structure, bonding, reactivity, properties, use in industry, materials, applications).
8. Chemistry of group 16 elements (mainly O, S, Se, Te; structure, bonding, reactivity, properties, use in industry, materials, applications).
9. Chemistry of group 17 elements (mainly F, Cl, Br, I; structure, bonding, reactivity, properties, use in industry, materials, applications).
10. Chemistry of group 18 elements (mainly Kr, Xe; structure, bonding, reactivity, properties, applications).
11. Renaissance of main group chemistry. Modern aspects of main group chemistry including catalysis and materials chemistry.

Recommended literature:
Suggested readings:
Housecroft, C. E.; Sharpe, A. G. Inorganic Chemistry, 5th ed.; Pearson: Harlow, UK, 2018.
Frontiers in Main Group Chemistry, Chemical Reviews 2019, 119, 8229-8954.
Baumgartner, T.; Jäkle, F. Main Group Strategies towards Functional Hybrid Materials, Wiley, 2018.
Modern Main Group Chemistry, Chemical Society Reviews 2016, 45, 763-1172.

Languages necessary to complete the course:
English

Notes:
offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Erik Rakovský, PhD., Mgr. Peter Hrobárik, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAgCh/N-mCAG-163/25	Advanced main group chemistry and applications

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 1 **per level/semester:** 13 / 13
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Seminars are evaluated at the end of the semester. From 100 pts that the student can get during the overall evaluation, a maximum of 50 pts is from the seminar evaluation where the student will prepare a seminar work along with a final short presentation on a selected topic. The seminar topics will be introduced by the lecturer during the first 2 weeks of the semester and one topic will be assigned to each student. The student will submit the seminar work no later than the last day of the teaching part of the semester. The submission of the seminar work is a condition to take the written examination. The written examination will be based on the content of lectures and the student can obtain a maximum of 50 pts.
The final grade is determined according to the following scale: A - at least 92 points, B - at least 84 points, C - at least 76 points, D - at least 68 points, E - at least 60 points.

Learning outcomes:
By completing the course, the students gain a comprehensive overview of the properties of main group elements and their compounds. Advanced topics in s and p block chemistry will be introduced, such as low coordinate main group element centres, base stabilised low valent main group compounds, hypervalent bonding, non-classical (3-center 2-electron, 3-center 4-electron, 4-center 2-electron) bonds, frustrated Lewis pairs and weakly coordinating anions. Students should recognise the importance of ligand properties and steric protection in the synthesis of low coordinate main group compounds including multiply bonded systems, to know the implications for their reactivity, understand the link between structure and bonding of various main group compound classes and their reactivity, including small molecule activation. The focus of the subject is mainly on technologically important non-transitional elements, their chemical and electrochemical production, practical use in materials and the latest knowledge in the chemistry and reactivity of their compounds. After successful completion of the subject, the student should have a comprehensive overview of the occurrence, electronic structure and applications of compounds of these elements, especially from the perspective of modern materials and technologies (such as fuel cells, semiconductors, batteries), industry, catalysis and biomedical applications.

Class syllabus:
Syllabus/Indicative Content:

1. Introduction to the advanced main group chemistry, electronic structure, bonding, reactivity.
2. Hydrogen, its production, hydrogen as a fuel, hydrogen intercalated compounds.
3. Inorganic and organometallic chemistry of alkali metals (Li, Na, K, Rb, Cs; structure, bonding, reactivity, properties, use in industry, materials, applications).
4. Inorganic and organometallic chemistry of alkali earth metals (Be, Mg, Ca, Sr, Ba, Ra; structure, bonding, reactivity, properties, use in industry, materials, applications).
5. Inorganic and organometallic chemistry of group 13 elements (B, Al, Ga, In, Tl; structure, bonding, reactivity, properties, use in industry, materials, applications).
6. Inorganic and organometallic chemistry of group 14 elements (C, Si, Ge, Sn, Pb; structure, bonding, reactivity, properties, use in industry, materials, applications).
7. Inorganic and organometallic chemistry of group 15 elements (N, P, As, Sb, Bi; structure, bonding, reactivity, properties, use in industry, materials, applications).
8. Chemistry of group 16 elements (mainly O, S, Se, Te; structure, bonding, reactivity, properties, use in industry, materials, applications).
9. Chemistry of group 17 elements (mainly F, Cl, Br, I; structure, bonding, reactivity, properties, use in industry, materials, applications).
10. Chemistry of group 18 elements (mainly Kr, Xe; structure, bonding, reactivity, properties, applications).
11. Renaissance of main group chemistry. Modern aspects of main group chemistry including catalysis and materials chemistry.

Recommended literature:

Suggested readings:

Housecroft, C. E.; Sharpe, A. G. Inorganic Chemistry, 5th ed.; Pearson: Harlow, UK, 2018.
Frontiers in Main Group Chemistry, Chemical Reviews 2019, 119, 8229-8954.
Baumgartner, T.; Jäkle, F. Main Group Strategies towards Functional Hybrid Materials, Wiley, 2018.
Modern Main Group Chemistry, Chemical Society Reviews 2016, 45, 763-1172.

Languages necessary to complete the course:

English

Notes:

offered in winter semester only

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Erik Rakovský, PhD., Mgr. Peter Hrobárik, PhD.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAgCh/N-mCAG-162/25	Advanced transition metal chemistry and applications

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 3.

Educational level: II.

Prerequisites:

Recommended prerequisites:
Not required but recommended: Bc. level General Chemistry; Inorganic Chemistry and/or Physical Chemistry (1) and/or Chemical Structure

Course requirements:
Oral exam with written preparation. Overall grading: A > 92; B > 84; C > 76; D > 68; E > 60; FX

Learning outcomes:
Advanced course of transition metal chemistry and coordination chemistry will focus on the reaction mechanisms, physical and catalytic properties, applications of transtion metal complexes and their biological relevance.

Class syllabus:
1. Basic definitions, nomenclature, isomerism in coordination compounds.
2. Chemical bonding in transition metal complexes. Ligand field theory. Magnetic properties of transition metal complexes. Absorption spectra of transition metal complexes. Molecular orbitals theory and comparison of both theories.
3. Kinetics and reaction mechanisms of coordination compounds.
4. Complexes of #-aceptor ligands.
5. Complexes of #-donor ligands. Metallocenes.
6. Transition metak complexes in catalysis.
7. Transition metal complexes in analytical chemistry.
8. Transition metal complexes in biological systems. Enzymomimetics. Chirality and biological activity.
9. Coordination polymers. Metal-organic frameworks.

Recommended literature:
1. Geoffrey A. Lawrance - Introduction to Coordination Chemistry, John Wiley & Sons Ltd., Chichester, UK, 2013. ISBN: 978-1-118-68140-4
2. Hani Amouri, Michel Gruselle - Chirality in Transition Metal Chemistry: Molecules, Supramolecular Assemblies and Materials, John Wiley & Sons Ltd., Chichester, UK, 2008. ISBN: 978-0-470-06053-7

3. Catherine E. Housecroft, Alan G. Sharpe - Inorganic Chemistry, 5th edition. Pearson, 2018. ISBN: 978-1-292-13414-7

Languages necessary to complete the course:
The course is taught in English. Recommended literature is in English.

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Erik Rakovský, PhD.

Last change: 04.02.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAgCh/N-mCAG-164/25	Advanced transition metal chemistry and applications

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 3.

Educational level: II.

Prerequisites:

Recommended prerequisites:
Not required but recommended: Bc. level General Chemistry; Inorganic Chemistry and/or Physical Chemistry (1) and/or Chemical Structure.

Course requirements:
Oral exam with written preparation. Overall grading: A > 92; B > 84; C > 76; D > 68; E > 60; FX

Learning outcomes:
Advanced course of transition metal chemistry and coordination chemistry will focus on the reaction mechanisms, physical and catalytic properties, applications of transtion metal complexes and their biological relevance.

Class syllabus:
Basic definitions, nomenclature, isomerism in coordination compounds.
2. Chemical bonding in transition metal complexes. Ligand field theory. Magnetic properties of transition metal complexes. Absorption spectra of transition metal complexes. Molecular orbitals theory and comparison of both theories.
3. Kinetics and reaction mechanisms of coordination compounds.
4. Complexes of #-aceptor ligands.
5. Complexes of #-donor ligands. Metallocenes.
6. Transition metak complexes in catalysis.
7. Transition metal complexes in analytical chemistry.
8. Transition metal complexes in biological systems. Enzymomimetics. Chirality and biological activity.
9. Coordination polymers. Metal-organic frameworks.

Recommended literature:
Recommended literature:
1. Geoffrey A. Lawrance - Introduction to Coordination Chemistry, John Wiley & Sons Ltd., Chichester, UK, 2013. ISBN: 978-1-118-68140-4

2. Hani Amouri, Michel Gruselle - Chirality in Transition Metal Chemistry: Molecules, Supramolecular Assemblies and Materials, John Wiley & Sons Ltd., Chichester, UK, 2008. ISBN: 978-0-470-06053-7
3. Catherine E. Housecroft, Alan G. Sharpe - Inorganic Chemistry, 5th edition. Pearson, 2018. ISBN: 978-1-292-13414-7

Languages necessary to complete the course:
#The course is taught in English. Recommended literature is in English

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Erik Rakovský, PhD.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-181/25	Advances in organic chemistry (1)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 1 **per level/semester:** 13
Form of the course: on-site learning

Number of credits: 1

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Active participation in seminars, discussions on pre-announced topics. It is necessary to attend at least 91% of all seminars for the A grade, at least 81% of all seminars for the B grade, at least 71% for the C grade, at least 61% of the seminars for the D grade, and at least 51% of the seminars for the E grade. Credits will not be awarded to a student who attends less than 50% of seminars.

Learning outcomes:
Aims and Objectives:
The aim of the subject is to acquaint students with the latest advances in organic and bioorganic chemistry.

Class syllabus:
Seminars on current topics of modern organic and bioorganic chemistry. Attention is paid mainly to organic synthesis, asymmetric catalysis, green chemistry, material and supramolecular chemistry, computational organic chemistry, physical-organic chemistry, medicinal chemistry and selected topics of biological chemistry.

Recommended literature:
Original research and review articles from scientific magazines.

Languages necessary to complete the course:
English

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Martin Putala, CSc.

Last change: 04.02.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-182/25	Advances in organic chemistry (2)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 1 **per level/semester:** 13
Form of the course: on-site learning

Number of credits: 1

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Active participation in seminars, discussions on pre-announced topics. It is necessary to attend at least 91% of all seminars for the A grade, at least 81% of all seminars for the B grade, at least 71% for the C grade, at least 61% of the seminars for the D grade, and at least 51% of the seminars for the E grade. Credits will not be awarded to a student who attends less than 50% of seminars.

Learning outcomes:
The aim of the subject is to acquaint students with the latest advances in organic and bioorganic chemistry.

Class syllabus:
Seminars on current topics of modern organic and bioorganic chemistry. Attention is paid mainly to organic synthesis, asymmetric catalysis, green chemistry, material and supramolecular chemistry, computational organic chemistry, physical-organic chemistry, medicinal chemistry and selected topics of biological chemistry.

Recommended literature:
Original research and review articles from scientific magazines.

Languages necessary to complete the course:
English

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Martin Putala, CSc.

Last change: 04.02.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-183/25	Advances in organic chemistry (3)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 1 **per level/semester:** 13
Form of the course: on-site learning

Number of credits: 1

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
The evaluation of the subject is the sum of the evaluation of: 1) preparation and presentation of the grant project for the diploma thesis during the semester (max. 35 pts), 2) presentation of the literature review and interim results in solving the diploma thesis at the end of the semester, with written support (max. 20 pts)), 3) active participation in the discussion about the goals and results of colleagues' works in points 1 and 2 (max. 5 pts) and 4) processing a detailed review of literary knowledge for the diploma thesis and correcting its shortcomings by the end of the examination period (40 pts).
Grade scale: A 90%-100%, B 80%-89%, C 70%-79%, D 60%-69%, E 50%-59%, Fx 49% and less.

Learning outcomes:
The student will become familiar with the world standards in research in chemistry, … (to be completed).

Class syllabus:
1) Principles of professional presentation.
2) Requirements for the processing of diploma theses. Requirements for characterizing the identity and purity of known and new compounds. Requirements for supplementary material when preparing a manuscript.
3) Training in chemical software for drawing structures, processing and analysing NMR data.
4) Searching in chemical databases. The use of artificial intelligence tools for efficient literature searching. Training in references management software and organization of references.
5) US and EU legislation related to Electronic Record Keeping, Good Manufacturing Practice and Good laboratory practice.
6) Calculation regarding the decision-making process based on a fictitious product specification and analytical results including an acceptable level of uncertainty resulting from repeated analytical measurements.
7) Design, execution and evaluation of scientific experiments: good science, sloppy science, generally accepted procedures; error, self-deception and fraud
8) Dissemination of scientific results: How does scientific publishing and peer review work? What is scientometrics? Predatory practices. Errors and fraud in scientific publishing.

9) Human interactions in science: Interactions between mentors and students, interactions with peers. Use of AI in science: Ethical and unethical uses
10) Possibilities of grant support for research in Slovakia and Europe. Training in writing and presentation of a grant project on the subject of a diploma thesis (scientific objectives, overview of knowledge from the literature, proposal of the project solution, budget, abstract).
11) Processing and presentation of achieved interim results in solving the project.
12) Processing a detailed review of the literature knowledge.

Recommended literature:
Review articles from scientific journals

Languages necessary to complete the course:
English

Notes:
offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Martin Putala, CSc.

Last change: 15.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-184/25	Advances in organic chemistry (4)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 1 **per level/semester:** 13
Form of the course: on-site learning

Number of credits: 1

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Active participation in seminars, discussions on pre-announced topics. It is necessary to attend at least 91% of all seminars for the A grade, at least 81% of all seminars for the B grade, at least 71% for the C grade, at least 61% of the seminars for the D grade, and at least 51% of the seminars for the E grade. Credits will not be awarded to a student who attends less than 50% of seminars.

Learning outcomes:
The aim of the subject is to acquaint students with the latest advances in organic and bioorganic chemistry.

Class syllabus:
Seminars on current topics of modern organic and bioorganic chemistry. Attention is paid mainly to organic synthesis, asymmetric catalysis, green chemistry, material and supramolecular chemistry, computational organic chemistry, physical-organic chemistry, medicinal chemistry and selected topics of biological chemistry.

Recommended literature:
Suggested readings: Original research and review articles from scientific magazines.

Languages necessary to complete the course:
English

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Martin Putala, CSc.

Last change: 04.02.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-155/25	Analysis and characterisation of bioactive ingredients

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The evaluation of the subject includes the verification of knowledge from seminars and lectures, for a maximum of 100 points. The seminar (maximum number of 40 points) includes the development and presentation of a seminar paper. The lecture (maximum number of 60 points) includes a final written test. The final grade includes the assessment from the final written test and the seminar. A total of at least 92 points is required to obtain an A grade, at least 84 points to obtain a B grade, at least 76 points for a C grade, at least 68 points for a D grade, and at least 60 points for an E grade. The evaluation is identical even for the distance form of education.

Learning outcomes:
Aims and Objectives:
The student will acquire knowledge about the sources and types of bioactive ingredients, including their classification based on individual structural types/subtypes. The student will acquire knowledge about the extraction, isolation and analytical characterization of active ingredients using various analytical techniques. The subject deals with structural factors influencing biological effect, factors influencing bioavailability and interactions with target sites. Physicochemical properties and methods of their modification are discussed. The processes/principles of discovery, research and development of bioactive ingredients and methods of biological screening, preclinical tests and clinical trials are briefly explained.

Class syllabus:
Syllabus/Indicative Content:
• Sources and types of bioactive ingredients
• Methods of classifications of bioactive ingredients
• Extraction and isolation
• Analytical characterizations, special analytical methods
• Interactions of bioactive ingredients with target sites
• Structural factors affecting activity
• Optimization of chemical structure
• Physicochemical properties affecting bioavailability

• Mechanisms and methods of investigating membrane transfer, transport in biosystems and biotransformation
• Research and development processes

Recommended literature:

Suggested readings:

1. Nollet, L.M.L.; Ahmad J. Bioactive Compounds from Food: Benefits and Analysis. CRC Press, 2024
2. Thakur, M.; Belwal, T. Bioactive Components. Springer Nature Singapore, 2023.
3. Pohanish, R.P. Sittig's Handbook of Pesticides and Agricultural Chemicals. Elsevier, 2015
4. Kerns, E.H.; Di, L. Drug-Like Properties: Concepts. Structure Design and Methods: From ADME to Toxicity Optimization; Academic Press, 2008.
5. Roche, V.F.; Zito, W.S.; Lemke, T.L.; Williams, D.A. Foye's Principles of Medicinal Chemistry. Wolters Kluwer, 2019.
6. Čulen, M.; Dohnal, J.; Jampílek J. Selected Analytical Techniques of Solid State, Structure Identification, and Dissolution Testing in Drug Life Cycle. Masaryk University Press, 2023.
7. Rouessac, F.; Rouessac, A. Chemical Analysis: Modern Instrumentation Methods and Techniques. John Wiley and Sons, 2022.

Languages necessary to complete the course:

English

Notes:

course offered in winter semester only

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. PharmDr. Josef Jampílek, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.KAlCh/N-CHEM-954/25	**Course title:** Analytical Chemistry
Number of credits: 3	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: doc. RNDr. Martin Putala, CSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-200/25	Analytical chemistry in practice

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): The evaluation of the subject includes the verification of knowledge from the lectures in the form of a final written test, for a maximum of 100 points. A total of at least 92 points is required to obtain an A grade, at least 84 points to obtain a B grade, at least 76 points for a C grade, at least 68 points for a D grade, and at least 60 points for an E grade. The evaluation is identical even for the distance form of education.

Learning outcomes:
Aims and Objectives:
The student will confirm knowledge from selected thematic areas of analytical chemistry and chemical analysis. The student will understand the connections between physico-chemical laws and chemical phenomena and their use in analytical techniques. After completing the subject, the student is able to fluently discuss individual aspects of analytical techniques based on the synthesis of knowledge. At the same time, he is able to propose effective methods of quantification of selected analytes in various samples using appropriate analytical methods of determination. The student will also become familiar with specific application areas that rely on analytical chemistry, such as pharmaceutical development, medical diagnostics, environmental protection and food analysis.

Class syllabus:
Syllabus/Indicative Content:
Theoretical and practical knowledge of analytical chemistry and chemical analysis, which synthesize knowledge obtained not only from profile subjects of the Analytical Chemistry study program. Synthetic information from an overview of professional scientific literature and student discussion with the teacher on selected topics. Creative thinking and critical evaluation will be encouraged.

Recommended literature:
Suggested readings:
Current monographic and magazine literature and Internet information resources. Original and review articles from professional magazines.

Languages necessary to complete the course:

English

Notes:
course offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. Ing. Roman Szücs, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-198/25	Analytical chemistry in society

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The subject is evaluated based on the submission of a report and an oral presentation on the assigned project topic. The resulting evaluation takes into account the quality of the submitted report and the presentation and the student's approach to obtaining and processing scientific literature, for a maximum of 100 points. It is necessary to get at least 92 points to get an A grade (excellent work), to get a B grade at least 84 points (above average work), to get a C grade at least 76 points (ordinary reliable work), to get a D grade at least 68 points (acceptable results) and for grade E at least 60 points (results meeting the minimum criteria). A student who does not meet the minimum criteria will receive an Fx rating.

Learning outcomes:
Aims and Objectives:
The student conducts literary research on a given topic and learns to obtain his/her own information from the available literature, which he/she then interprets under the expert supervision of the teacher.

Class syllabus:
Syllabus/Indicative Content:
• Work with literary sources and interpretation of experiments under the professional guidance of pedagogical and scientific workers on a specifically assigned topic. Theoretical preparation for the diploma thesis.

Recommended literature:
Suggested readings:
Selected chapters from monographs and publications in scientific journals according to the focus of the project.

Languages necessary to complete the course:
English

Notes:
course offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Marian Masár, PhD., doc. Ing. Roman Szücs, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-186/25	Asymmetric catalysis

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 4.

Educational level: II.

Prerequisites:

Course requirements:
The course evaluation is based on a written test comprising of writing products and catalysts of a series or stereoselective catalytic reactions on topics discussed during the course. The course has a standardized grading system which is identified below:
A (92 – 100%): Outstanding, excellent work (exceptional performance with strong evidence of original thinking and obvious capacity to analyze, synthesize and evaluate. B (84 – 91 %): Good, competent work; laudable performance with evidence of some original thinking, good problem-solving ability, exhibiting a serious, responsible engagement with the course content. C (76 – 83%): Adequate, reasonably satisfactory work; fair performance but infrequent evidence of original thinking or the capacity to analyze, satisfies the minimum requirements of the course. D (68 – 75%): Less acceptable work; relatively weak performance with little evidence of original thinking or ability to analyze or synthesize course material. E (60 – 67%): Minimally acceptable work; very weak performance with little evidence of original thinking, showing an inadequate grasp of some basic elements of the course. Fx (under 60%): Inadequate work; poor performance that indicates a lack of understanding or misunderstanding of essential subject matter.

Learning outcomes:
The aim of the course is to familiarize students with the basic principles of asymmetric catalysis. It gives an overview of the most important methods, with an emphasis on complex transition metal catalyzed reactions, organocatalytic and enzymatic methods. Use of asymmetric catalysis in practice is also discussed.

Class syllabus:
Introduction to catalysis. Overview of asymmetric catalysis methods. Transition metal-catalyzed asymmetric hydrogenations. Transition metal-catalyzed asymmetric oxidations. Enantioselective reactions of C-C bond formation. Enantioselective reactions of C-heteroatom bond formation. Asymmetric catalytic isomerizations. Asymmetric covalent and non-covalent organocatalysis. Enantioselective enzymatic reactions, whole cells, and tissues, catalytic antibodies, and ribozymes as catalysts. Heterogeneous catalysts and other possibilities of immobilization. Dual activation. Enantioselective autocatalysis. Use of asymmetric catalysis in industrial practice.

Recommended literature:
1. P. J. Walsh, M. C. Kozlowski, Fundamentals of Asymmetric Catalysis, University Science Books, Sausalito, 2009; 2. E. M. Carreira, L. Kvaerno, Classics in stereoselective synthesis, Wiley-VCH, Weinheim, 2009.

Languages necessary to complete the course:
1. P. J. Walsh, M. C. Kozlowski, Fundamentals of Asymmetric Catalysis, University Science Books, Sausalito, 2009; 2. E. M. Carreira, L. Kvaerno, Classics in stereoselective synthesis, Wiley-VCH, Weinheim, 2009.

Notes:
offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. Mgr. Radovan Šebesta, DrSc.

Last change: 04.02.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-170/25	Basic of chemical biology

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 1 **per level/semester:** 13 / 13
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): The evaluation of the course is divided into two parts. The first part of the assessment will be the preparation and presentation of the semester project. This project will allow students to improve their orientation in professional literature, while the choice of topic will be related to the lectured issue. Presenting the project will subsequently ensure the possibility of improving public speaking and discussing professional topics. The expected length of the presentation will be 10 minutes, including discussion. The semester project will represent 30% of the overall evaluation of the subject. The second part of the subject evaluation will be a short written test (70% of the total evaluation). It is necessary to get at least 92% for grade A, at least 84% for grade B, at least 76% for grade C, at least 68% for grade D and at least 60% for grade E.

Learning outcomes:
Aims and Objectives:
This course aims to enable students to acquire knowledge in the field of chemical biology and thereby understand how to apply chemistry approaches to the study of biological processes.
The principles of bioorthogonal chemistry, drugs containing transition metals, the use of labeled probes to study the interactions of biomacromolecules or protein expression, and the industrial use of enzymes will be discussed against the background of the expansion of knowledge about nucleic acids, proteins, carbohydrates, lipids, and terpenes.
The knowledge gained during the completion of this subject will serve as a basis for participation in interdisciplinary research projects at the interface of chemistry and biology.

Class syllabus:
Syllabus/Indicative Content:
• Basics of chemical biology, chemical origin of biology, drug development;
• DNA, function and structure of DNA, chemical and biological synthesis of oligonucleotides, electrophoretic separation of DNA molecules, DNA sequencing, DNA nanotechnology and "self-assembly", DNA photochemistry, DNA as a drug target, gene manipulations, CRISPR/Cas9 method, focus on chemical reactions taking place on nucleic acids;
• RNA, RNA function and structure, chemical synthesis of ribooligonucleotides, transcription and its influence, RNA translation, RNA degradation;

• Peptides and proteins, chemical and biological synthesis of proteins, labeling and chemical reactions of proteins;
• Carbohydrates, structure, glycolysis, polysaccharides and glycoproteins, synthesis of oligosaccharides, lipids and terpenes;
• Bioorthogonal chemistry, chemical reactions taking place in a biologically relevant environment;
• Selection of a target protein for the design of chemical probes and small biologically active molecules, combinatorial chemistry, drug development, stapled proteins and aptamers, protein interactions, PROTAC.

Recommended literature:

Suggested readings:

1) D. Vranken, G. Weiss; Introduction to Bioorganic Chemistry and Chemical Biology, Garland Science, 2012.
2) A. Miller, J. Tanner. Essentials of Chemical Biology – Structure and Dynamics of Biological Macromolecules, Wiley-VCH, 2024.
3) M. Schmidt; Chemical Biology and Drug Discovery, Springer, 2022.

Languages necessary to complete the course:

English

Notes:

offered in winter semester only

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers:

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.KAlCh/N-CHEM-955/25	**Course title:** Bioanalytical chemistry
Number of credits: 2	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: doc. RNDr. Martin Putala, CSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-197/25	Bioanalytical chemistry

Educational activities:
Type of activities: seminar
Number of hours:
per week: 3 **per level/semester:** 39
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The final grade includes the evaluation of the seminar work and the final written test, totaling a maximum of 100 points. Preparation and presentation of the seminar work - the maximum number is 40 points and the final written examination - the maximum number is 60 points. A total of at least 92 points is required to obtain an A grade, at least 84 points to obtain a B grade, at least 76 points for a C grade, at least 68 points for a D grade, and at least 60 points for an E grade. The evaluation is identical even for the distance form of education.

Learning outcomes:
Aims and Objectives:
The student will become familiar with information about the current status of bioanalytical chemistry and collection and processing methods of biological samples. The subject is also intended for students of biochemistry or biology interested in analytical techniques suitable for studying a wide range of biomolecules, for example hormones, amino acids, peptides, proteins, nucleic acids, carbohydrates and the like. The content of the subject is complementary to the knowledge that is usually not included in ordinary textbooks of analytical chemistry. The student will understand the interdisciplinary nature of bioanalysis and the principles of electrophoresis, liquid chromatography, biosensors, analytical methods of DNA and protein separation, combination of PCR and final analytical methods. The student will be a co-investigator of sample problems from the fields of biochemistry, biotechnology and other natural sciences. The student knows how to navigate modern methods of analytical chemistry suitable for the analysis of biological samples.

Class syllabus:
Syllabus/Indicative Content:
• Defining areas of interest, problems, strategies, procedures, methods, applications and the position of bioanalysis in the scientific system of analytical chemistry.
• Biologically significant molecules and the need for their determination in biological samples.
• Specific properties and characteristics of biological samples (microbiological, biotechnological, plant, animal, food).

• Biological variability of samples. Rules for collection, storage, processing and treatment of biological samples.
• Body fluid samples - blood, serum, plasma, urine, saliva, cerebrospinal fluid, tissues.
• Use of biochemical and biological principles for the purposes of chemical analysis of biosamples.
• Specific requirements for instrumentation for bioanalysis.
• Specific requirements conditioned by the nature of biosamples and limitations in their analysis.
• Extraction in the solid phase-liquid system in bioanalysis, biochromatography, denaturation chromatography, electroseparation methods.
• Bioanalysis in genomics. Relationships between bioseparation methods and PCR.
• Bioanalysis in proteomics. Protein sequencing. Validation problems in the bioanalysis of biomacromolecules.
• Chemical analysis of metabolites - metabolomics, metabolomics. Criteria for evaluation and interpretation of results in bioanalysis.
• Trends in the development of analytical instruments and devices. Biocompatibility of construction materials.

Recommended literature:

Suggested readings:

1. V. A. Gault, N. H. McClenaghan, Understanding Bioanalytical Chemistry. Principles and Applications, Wiley-BlackWell, John Wiley & Sons,, Chichester, 2009.
2. Manz, N. Pamme, D. Iossifidi, Bioanalytical Chemistry, Imperial College Press, London 2004.
3. G. Evans (ed.), A Handbook of Bioanalysis and Drug Metabolism, CRC Press 2004.
4. R. F. Venn, Principles and Practice of Bioanalysis, CRC Press, 2003.

Languages necessary to complete the course:

English

Notes:

course offered in winter semester only

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Marian Masár, PhD., doc. Ing. Roman Szücs, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAn/N-XXXX-005/21	Bioarchaeology

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1., 3.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 1375

A	B	C	D	E	FX
69,67	9,82	6,55	5,45	4,36	4,15

Lecturers: doc. RNDr. Radoslav Beňuš, PhD., Mgr. Silvia Bodoriková, PhD., RNDr. Michaela Dörnhöferová, PhD.

Last change: 07.11.2022

Approved by: doc. RNDr. Martin Putala, CSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.KOrCh/N-CHEM-950/25	**Course title:** Bioinorganic and bioorganic chemistry
Number of credits: 1	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: doc. RNDr. Martin Putala, CSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-169/25	Bioorganic chemistry

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 1 **per level/semester:** 13 / 13
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): Grades will be based on the results of two written tests and final exam. More than 50% of points must be obtained from each part of the grading. To obtain a total A rating it is necessary to obtain on average at least 90% of points, to obtain a B rating at least 80% points, to a C rating at least 70% points, to a D rating at least 60% points and to an E rating at least 50% points. Credits will not be awarded to a student who scores less than 50% of the points.

Learning outcomes:
Aims and Objectives:
The course's topic is the basic concepts of bioorganic chemistry. Students will learn about the structure, properties, and functions of primary metabolites and biopolymers. They will expand their knowledge in organic chemistry, biochemistry, stereochemistry, and supramolecular chemistry. Particular emphasis is placed on studying metabolic transformations in terms of the mechanisms of organic reactions.

Class syllabus:
Syllabus/Indicative Content:
Introduction, framework, and basic concepts of bioorganic chemistry. Types of biopolymers and their metabolic functions. Essential pathways of primary metabolism and their importance in anabolic processes. Structure and function of the common coenzymes. Nitrogen cycle, physical and chemical properties of proteinogenic amino acids. Classification of amino acids according to metabolic origin. Construction of proteins from amino acids and hierarchy of their structures. Protein interactions and types of protein bioconjugates. Covalent and non-covalent interactions and their influence on the structure and properties of proteins. The concept of molecular recognition explained with the examples of receptors, lectins, histones, and antibodies. Importance and metabolic function of globines. Bioinformatics and searching in protein databases. Kinetics of enzymatic reactions, enzyme catalysis. Structure of enzymes, the importance of active centers, coenzymes, and cofactors. The function of enzymes with an emphasis on the chemical mechanisms of metabolic transformations explained with specific examples. Chemical structure and properties of cell membranes, structure and function of lipoproteins. Construction and degradation of fatty acids. The effect of cholesterol on the properties of cell membranes, the concept of liquid

mosaic. Function of transmembrane proteins. Nomenclature and structure of carbohydrates. Distribution of monosaccharides, anomeric effect. Essential pathways of carbohydrate metabolism. Biosynthesis of disaccharides, polysaccharides, glycosides, and glycoconjugates. The importance of glycoconjugates in human metabolism and the biosynthesis of glycome building blocks. Biosynthesis and structure of nucleotides. Biosynthesis and function of some coenzymes with explanation of chemical mechanisms. Primary and secondary structure of nucleic acids and their function in the genetic code, DNA replication, and gene expression. Genome editing methods, genetic modifications, CRISPR/Cas9 method.)

Recommended literature:

Suggested readings:

Dugas, H. Bioorganic Chemistry: A Chemical Approach to Enzyme Reactions, Springer-Verlag, New York, 1999.

Jain, J. L. Fundamentals of Biochemistry; S. Chand Publishing, New Delhi, 2004.

Dobson, C. M.; Gerrard, J. A.; Pratt, A. J. Foundations of Chemical Biology; Oxford Chemistry Primers, Oxford, 2002.

Davis, B. G.; Fairbanks, A. J. Carbohydrate Chemistry, Oxford Chemistry Primers, Oxford, 2002.

Mann, J. Chemical Aspects of Biosynthesis; Oxford Chemistry Primers, Oxford, 2011.

Languages necessary to complete the course:

English

Notes:

offered in winter semester only

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Ambroz Almássy, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KMB/N-mBMO-188/25	Biotechnology and biomedicine

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
#The course is taught in English. Recommended literature is in English

Learning outcomes:
Aims and Objectives:
Students will gain knowledge about molecular, microbiological, technological and legislative processes in biomedical diagnostics and therapy. They will get an overview of the latest approaches in the fields of molecular diagnostics, personalized medicine, regenerative and gene therapy, and selected areas of oncology and infectious diseases. Students will practice the ability to search for further information and learn to compile information into logical units in the form of a presentation. They will gain the experience of presentation and discussion with classmates, and thus will gain more confidence for future presentations.

Class syllabus:
Syllabus/Indicative Content:
1. Molecular diagnostics in medicine: Diagnostics of bacterial and viral infections. Overview of molecular-biological methods used in the diagnosis of bacterial and viral diseases.
2. Therapy of infectious diseases: Antibiotics and the antibiotic crisis. Development of new drugs for the therapy of infectious diseases.
3. Diagnosis and therapy of cancer diseases: Oncomarkers and their use in diagnostics. Targeted treatment of cancer diseases.
4. Model organisms in the research of new therapeutic strategies: Transgenic model organisms, their preparation and use.
5. Stem cells and regenerative medicine: Properties of stem cells. Embryonic and adult stem cells, tumor and induced pluripotent stem cells. Production of tissues and organs. Biomaterials.
6. Personalized medicine: Heterogeneity of Genetic Diseases and Targeted Drug Design.
7. Reproductive medicine: Possibilities and methods of pre-implantation diagnostics.

Recommended literature:
Suggested readings:
Groves M. J., 2006: Pharmaceutical biotechnology-second edition, CRC press, 396 pp.

Walsh, G.., 2007: Pharmaceutical biotechnology. John Wiley and Sons Ltd, 465 pp.
Watson J.D. et al. 2007: Recombinant DNA (3. edition). WH Freeman and Co.
Glick. BR and Pastrenak JJ 2003 Molecular Biotechnology (3. edition) ASM Press

Languages necessary to complete the course:
English

Notes:
offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Hana Drahovská, PhD., doc. Mgr. Andrea Šoltýsová, PhD., doc. Mgr. Andrej Ficek, PhD.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.LPM/N-CHEM-956/25	**Course title:** Characterization methods in materials chemistry
Number of credits: 2	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: doc. RNDr. Martin Putala, CSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.LPM/N-mLPM-004/25	Characterization methods in materials chemistry

Educational activities:
Type of activities: practicals / lecture
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Grading: The grading is based on a written test including examples taken during the course period. The overall grading : A: 92-100%, B: 84-91%, C: 76-83%, D: 68-75%, E: 60-67

Learning outcomes:
Objectives of the course:
Students will learn key methods used in characterization of materials including principle of the methods, different measurements techniques in each method, analysis of the measured data.

Class syllabus:

Recommended literature:
Original literature in the field of chemistry of materials.

Languages necessary to complete the course:
The course is taught in English. Recommended literature is in English.

Notes:
course offered in winter semester only

Past grade distribution
Total number of evaluated students: 1

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Roman Bystrický, PhD.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.LPM/N-mLPM-009/25	Chemical calculations

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Grading: There will be two written tests given during the semester (maximum 20 points each). Final exam will be a test, for which students can get maximum 60 points. For grade A, it is necessary to obtain at least 92 %, for grade B at least 84 %, for grade C at least 76 %, for grade D at least 68 % and for grade E at least 60 % of all points. Students, who will obtain less than 60 points will receive grade FX (fail).

Learning outcomes:
The objective of the course is to help students master the basic chemical calculations.

Class syllabus:
Abbreviated syllabus:
Quantities used in chemical calculations. Correct rounding of results (decimals, valid digits). Substance quantity in relation to number of particles, mass and volume. Stoichiometry of chemical formulas: mass fraction and calculations of the composition of compounds from their formulas and vice versa. Stoichiometry of chemical equations: calculations of coefficients of equations without redox processes and equations of simple redox reactions. Stoichiometry of chemical equations: calculations of coefficients of more complex redox equations: disproportionation, synproportionation, with atoms of three elements changing oxidation number, with atoms with non-integer oxidation numbers. Stoichiometry of chemical reactions: calculations of quantities of substances according to chemical equations. Calculations using the ideal gas laws. Quantities expressing the composition of solutions - an overview. Calculations with mass fraction. Calculations using mass concentration and mass fraction. Calculations using molality and other ways of expressing the composition of solutions. Calculations related to dilution and mixing of solutions. Calculations related to the preparation of multicomponent solutions. Calculations in the preparation of aqueous solutions from anhydrous substances and from hydrates. Calculations of composition of solutions. Concepts of solubility and saturated solution. Calculation of the amount of solvent to prepare a saturated solution. Solubility constant. Calculations according to chemical equations including calculations related to solutions. Calculations for carrying out synthesis problems.

Recommended literature:

Original literature in the field of chemistry of materials.

Languages necessary to complete the course:
#The course is taught in English. Recommended literature is in English.

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Roman Bystrický, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-153/25	Chromatographic separation methods

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The evaluation of the subject includes the examination of knowledge from seminars, exercises and lectures, for a maximum of 100 points. The seminar (maximum number of 40 points) includes the development and presentation of a seminar paper. The lecture (maximum number of 60 points) includes a final written test. The final grade includes the assessment from the final written test, seminar and exercise. A total of at least 92 points is required to obtain an A grade, at least 84 points to obtain a B grade, at least 76 points for a C grade, at least 68 points for a D grade, and at least 60 points for an E grade.

Learning outcomes:
Aims and Objectives:
The student will become familiar with information about the position of chromatographic methods in the system of scientific knowledge of the world; their need for the separation of various substances and the generation of an analytical signal. The student will gain information about analytical, preparative and industrial applications of chromatographic principles and separation mechanisms in combined separation processes and methods. The student can handle advanced calculations in the field of liquid and gas chromatography and solve model situations from practice. After successfully completing the education process, the student will be able to correctly design and perform qualitative and quantitative analysis of samples using chromatography.

Class syllabus:
Syllabus/Indicative Content:
• Characteristics of separation mechanisms and methods, function and importance of chromatography in analytical, preparative and industrial procedures.
• Interactions in chromatographic separation systems. Calculations, thermodynamic and kinetic aspects of liquid-chromatographic methods, the relationship between the concepts of separation and resolution.
• Chromatographic separations, classification according to various criteria. Theory of the chromatographic process, qualitative and quantitative chromatographic analysis.
• Chromatographic Instrumentation.

• Chromatographic systems. Advanced techniques. Computer simulations and calculations.
• Separation mechanisms. Systems with a normal arrangement of stationary and mobile phases. Systems with inverted (reverse) arrangement of stationary and mobile phases. Adsorption, partition, ion-exchange, affinity and gel liquid chromatography. Chromatography using predominantly hydrophilic interactions (HILIC)
• Bioaffinity. Methods of separation of components of chiral substances (diastereoisomers, enantiomers).
• Detectors used in chromatography.
• Pre-column and post-column derivatization (physical, chemical and biological). Validation of analytical methods. Maintenance and search for errors and malfunctions.
• Solving problems from various areas of social and production practice and the use of chromatographic methods in analytical procedures, preparative and industrial procedures (case studies) in selected areas (clinical diagnostics, control of environmental components, food quality control, pharmaceutical and biotechnological applications).
• The future of chromatography methods, miniaturization, comprehensive, multidimensional liquid chromatography, etc.

Recommended literature:
Suggested readings:
1. R.P.W. Scott, Principles and practice of chromatography, Library for science, Book 1, 2003, Liquid Chromatography Book 3, 2003.
2. D. Corradini, Handbook of HPLC, 2. vyd., CRC Press 2010.
3. L.R. Snyder, J.J. Kirkland, J.L. Glajch, Practical HPLC Method Development, 2. vyd., J. Wiley & Sons, 1997, on-line: 2012.

Languages necessary to complete the course:
English

Notes:
course offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. Ing. Roman Szücs, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KFTCh/N-mCFZ-190/25	Computer modeling of solids

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 2.

Educational level: II.

Prerequisites:

Recommended prerequisites:
It is highly recommended that the attendee has taken (or is currently taking) the Introduction to Solid State Physics course

Course requirements:
Grading: Working knowledge of mathematics, physics and physical chemistry taught in BS-level core courses. Assessment of students' knowledge will be an oral examination or test. Grade scale: A 91-100%, B 81-90 %, C 71-80 %, D 61-70 %, E 51-60 %, Fx 50 % and less.

Learning outcomes:
Objectives of the course: Selected problems in solid state physics and thermodynamics will be solved using computer simulations. The aim of the course is to deepen the understanding of physico-chemical problems at an intuitive level and to acquire the basic skills necessary for the use of simulations techniques in student’s own research.

Class syllabus:
Abbreviated syllabus: VASP simulation package - basic principles and use, atoms and molecules, from molecules to periodic systems, crystal vs. electronic structure, thermodynamics from first principles: first order phase transition, diffusion of an ad-atom on a metal surface, phonons, vibrational properties of crystals, molecular dynamics and simulation of group transformation

Recommended literature:
Recommended literature:
R. G. Parr, W. Yang: Density functional theory of atoms and molecules, Oxford University Press, New York 1989.
N. W. Ashcroft, N. D. Mermin: Solid state physics, Harcourt College Publishers 1976.
P. Atkins, J. de Paula: Atkins‘ Physical Chemistry, Oxford University Press, New York 2002.

Languages necessary to complete the course:
#The course is taught in English. Recommended literature is in English.

Notes:

Past grade distribution Total number of evaluated students: 0					
A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0
Lecturers: doc. Ing. Tomáš Bučko, PhD.					
Last change: 16.01.2026					
Approved by: doc. RNDr. Martin Putala, CSc.					

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-156/25	Contemporary analytical methods

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The subject is evaluated based on the submission of a report and an oral presentation on the assigned project topic. The resulting evaluation takes into account the quality of the submitted report and the presentation and the student's approach to obtaining and processing scientific literature, for a maximum of 100 points. It is necessary to get at least 92 points to get an A grade (excellent work), to get a B grade at least 84 points (above average work), to get a C grade at least 76 points (ordinary reliable work), to get a D grade at least 68 points (acceptable results) and for grade E at least 60 points (results meeting the minimum criteria). A student who does not meet the minimum criteria will receive an Fx rating.

Learning outcomes:
Aims and Objectives:
The student conducts literary research on a given topic and learns to obtain his own information from the available literature, which he then interprets under the expert supervision of the teacher.

Class syllabus:
Syllabus/Indicative Content:
• Work with literary sources and interpretation of experiments under the professional guidance of pedagogical and scientific workers on a specifically assigned topic. Theoretical preparation for the diploma thesis.

Recommended literature:
Suggested readings:
Selected chapters from monographs and publications in scientific journals according to the focus of the project.

Languages necessary to complete the course:
English

Notes:
course offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Marian Masár, PhD., doc. Ing. Roman Szücs, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-159/25	Contemporary bioanalytical methods

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The subject is evaluated based on the submission of a report and an oral presentation on the assigned project topic. The resulting evaluation takes into account the quality of the submitted report and the presentation and the student's approach to obtaining and processing scientific literature, for a maximum of 100 points. It is necessary to get at least 92 points to get an A grade (excellent work), to get a B grade at least 84 points (above average work), to get a C grade at least 76 points (ordinary reliable work), to get a D grade at least 68 points (acceptable results) and for grade E at least 60 points (results meeting the minimum criteria). A student who does not meet the minimum criteria will receive an Fx rating.

Learning outcomes:
Aims and Objectives:
The student conducts literary research on a given topic and learns to obtain his own information from the available literature, which he then interprets under the expert supervision of the teacher.

Class syllabus:
Syllabus/Indicative Content:
• Work with literary sources and interpretation of experiments under the professional guidance of pedagogical and scientific workers on a specifically assigned topic. Theoretical preparation for the diploma thesis.

Recommended literature:
Suggested readings:
Selected chapters from monographs and publications in scientific journals according to the focus of the project.

Languages necessary to complete the course:
English

Notes:
course offered in summer semester only

Past grade distribution Total number of evaluated students: 0					
A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0
Lecturers: doc. Ing. Roman Szücs, PhD., prof. RNDr. Marian Masár, PhD.					
Last change: 20.01.2026					
Approved by: doc. RNDr. Martin Putala, CSc.					

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCXX-004/25	Data processing and analysis

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 2 **per level/semester:** 13 / 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
The evaluation of the subject includes the verification of knowledge from seminars and lectures, for a maximum of 100 points. The seminar (maximum number of 40 points) includes the development and presentation of a seminar paper. The lecture (maximum number of 60 points) includes a final written test. The final grade includes the assessment from the final written test, seminar and exercise. A total of at least 92 points is required to obtain an A grade, at least 84 points to obtain a B grade, at least 76 points for a C grade, at least 68 points for a D grade, and at least 60 points for an E grade.

Learning outcomes:
The student will gain knowledge from the basics of mathematical data processing and its wide application in practice, from planning effective laboratory experiments, environmental protection to the development of new drugs. Mathematical processing of chemical data plays an important role in the interpretation of measured data and also in the extrapolation of laboratory experiments to operational conditions. Digitization is considered a decisive activity in accelerating development in many industries, e.g. in the pharmaceutical and food industry. After completing the subject, the student can design an effective "in-silico" experiment that will be part of this subject and is important not only from the point of view of accelerating new discoveries, but also plays an important role in environmental protection.

Class syllabus:
• Introduction to the subject, importance of mathematical processing of chemical data, examples of applications (development of new drugs, prediction of physico-chemical properties of compounds or toxicity, development of analytical methods).
• Importance of data structure, digitization of chemical structure, design, use, search of databases of chemical substances. Calculation of structural descriptors and basic physico-chemical properties of substances, e.g. pKa, LogP, LogD.
• Use of structural similarity in predicting chemical properties, calculation of fingerprints of chemical substances.
• Software for mathematical processing of chemical data. ACD labs, introduction to the principles of open source and software. ChemPy, CDK, JChem.

• Design and extrapolation of laboratory experiments in the development of new analytical methods, LC-GC simulator. Software simulation of MS or NMR spectra.
• Introduction to the development of mathematical models, machine learning techniques (Machine Learning) and artificial intelligence (Artificial Intelligence) in chemistry.
• Regression and classification algorithms, principles and use of evolutionary algorithms in the optimization of chemical processes, search for significant structural descriptors.
• Basic data and statistical analysis (elimination of outliers, normal distribution, probability intervals), profiling, modelling and visualisation in popular table processors
• Supervised, semi-supervised, unsupervised, and reinforced learning, features classification and engineering, model training and evaluation
• In-depth introduction to selected ML models (logistic regression, K-means, artificial neural networks)
• Open source platform for developing mathematical models, WEKA. practical use
• Case studies, application of mathematical processing of chemical data.

Recommended literature:

1. Witten, I.H.; Frank, E.; Hall, M.A.; Pal, C.J. Data Mining: Practical Machine Learning Tools and
Techniques, 4th ed.; Morgan Kaufmann: Cambridge, MA, USA, 2016.
2. Kaliszan, R. Quantitative structure property (retention) relationships in liquid chromatography. In Liquid Chromatography: Fundamentals and Instrumentation, 2nd ed.; Fanali, S., Haddad, P.R., Poole, C.F., Riekkola, M.-L., Eds.; Elsevier: Amsterdam, The Netherlands, 2017; pp. 553–572.
3. Mauri, A.; Consonni, V.; Todeschini, R. Molecular descriptors. In Handbook of Computational Chemistry, 2nd ed.; Leszczynski, J., Kaczmarek-Kedziera, A., Puzyn, T., Papadopoulos, M.G., Reis, H., Shukla, M.K., Eds.; Springer: Cham, Switzerland, 2017; pp. 2065–2093.
4. Leardi, R. Genetic algorithms in chemistry. J. Chromatogr. A 2007, 1158, 226–233.

Languages necessary to complete the course:
English

Notes:
course offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. Ing. Roman Szücs, PhD., doc. Mgr. Michal Pitoňák, PhD.

Last change: 15.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJ/N-mXCJ-078/22	Deutsch für Naturwissenschaftler A1 (začiatočníci)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 79

A	B	C	D	E	FX
98,73	0,0	0,0	0,0	0,0	1,27

Lecturers: Mgr. Karin Rózsová Wolfová

Last change: 24.07.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJ/N-mXCJ-080/22	Deutsch für Naturwissenschaftler A2 (začiatočníci)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 39

A	B	C	D	E	FX
94,87	0,0	0,0	0,0	0,0	5,13

Lecturers: Mgr. Karin Rózsová Wolfová

Last change: 24.07.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJ/N-mXCJ-079/22	Deutsch für Naturwissenschaftler B1 (pokročilí)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 37

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Karin Rózsová Wolfová

Last change: 24.07.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJ/N-mXCJ-081/22	Deutsch für Naturwissenschaftler B2 (pokročilí)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 10

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Karin Rózsová Wolfová

Last change: 24.07.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCXX-009/25	Diploma thesis (1)

Educational activities:
Type of activities: practicals / seminar
Number of hours:
per week: 10 / 2 **per level/semester:** 130 / 26
Form of the course: on-site learning

Number of credits: 12

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
offered in winter semester only

Learning outcomes:
The aim of the subject is to carry out and evaluate the experiments for the diploma thesis. By completing it, the student will obtain the necessary amount of own experimental results of the required quality, which will form the core of the diploma thesis.

Class syllabus:
Completion of independent research work as a basis for the diploma thesis. Verification of achieved results (repetition of key experiments), analysis, identification and characterization of compounds/ materials. Analysis of the results and their consultation with the supervisor. Original research and review articles from scientific journals.

Recommended literature:
Original research and review articles from scientific journals.

Languages necessary to complete the course:
English

Notes:
offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers:

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCXX-010/25	Diploma thesis (2)

Educational activities:
Type of activities: practicals / seminar
Number of hours:
per week: 10 / 2 **per level/semester:** 130 / 26
Form of the course: on-site learning

Number of credits: 12

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
offered in winter semester only

Learning outcomes:
The aim of the subject is to carry out the and evaluate the experiments for the diploma thesis. By completing it, the student will obtain the necessary amount of own experimental results of the required quality, which will form the core of the diploma thesis.

Class syllabus:
Completion of independent research work as a basis for the diploma thesis. Verification of achieved results (repetition of key experiments), analysis, identification, and characterization of compounds/ materials. Analysis of the results and their consultation with the supervisor.

Recommended literature:
Original research and review articles from scientific journals.

Languages necessary to complete the course:
English

Notes:
offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers:

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.KOrCh/N-mOBH-101/25	**Course title:** Diploma thesis defence
Number of credits: 10	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: doc. RNDr. Martin Putala, CSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCXX-008/25	Diploma thesis project

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 1 **per level/semester:** 13 / 13
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
The evaluation of the subject is the sum of the evaluation of: 1) preparation and presentation of the grant project for the diploma thesis during the semester (max. 35 pts), 2) presentation of the literature review and interim results in solving the diploma thesis at the end of the semester, with written support (max. 20 pts)), 3) active participation in the discussion about the goals and results of colleagues' works in points 1 and 2 (max. 5 pts) and 4) processing a detailed review of literary knowledge for the diploma thesis and correcting its shortcomings by the end of the examination period (40 pts).
Grade scale: A 90%-100%, B 80%-89%, C 70%-79%, D 60%-69%, E 50%-59%, Fx 49% and less.

Learning outcomes:
The student will become familiar with the world standards in research in chemistry, … (to be completed).

Class syllabus:
1) Principles of professional presentation.
2) Requirements for the processing of diploma theses. Requirements for characterizing the identity and purity of known and new compounds. Requirements for supplementary material when preparing a manuscript.
3) Training in chemical software for drawing structures, processing and analysing NMR data.
4) Searching in chemical databases. The use of artificial intelligence tools for efficient literature searching. Training in references management software and organization of references.
5) US and EU legislation related to Electronic Record Keeping, Good Manufacturing Practice and Good laboratory practice.
6) Calculation regarding the decision-making process based on a fictitious product specification and analytical results including an acceptable level of uncertainty resulting from repeated analytical measurements.
7) Design, execution and evaluation of scientific experiments: good science, sloppy science, generally accepted procedures; error, self-deception and fraud
8) Dissemination of scientific results: How does scientific publishing and peer review work? What is scientometrics? Predatory practices. Errors and fraud in scientific publishing.

9) Human interactions in science: Interactions between mentors and students, interactions with peers. Use of AI in science: Ethical and unethical uses
10) Possibilities of grant support for research in Slovakia and Europe. Training in writing and presentation of a grant project on the subject of a diploma thesis (scientific objectives, overview of knowledge from the literature, proposal of the project solution, budget, abstract).
11) Processing and presentation of achieved interim results in solving the project.
12) Processing a detailed review of the literature knowledge.

Recommended literature:
Review articles from scientific journals

Languages necessary to complete the course:
English

Notes:
offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Martin Putala, CSc.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJ/N-mXCJ-076/22	EAP 1/English for Academic Purposes

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 349

A	B	C	D	E	FX
78,8	16,62	3,15	0,0	0,86	0,57

Lecturers: PhDr. Štefánia Dugovičová, PhD., Mgr. Lenka Jeleňová, Mgr. Barbara Kordíková, PhD., PaedDr. Stanislav Kováč, PhD., RNDr. Tatiana Slováková, PhD.

Last change: 26.09.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJ/N-mXCJ-077/22	EAP 2/English for Academic Purposes

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 224

A	B	C	D	E	FX
83,48	12,05	1,79	0,45	0,45	1,79

Lecturers: PhDr. Štefánia Dugovičová, PhD., Mgr. Lenka Jeleňová, Mgr. Barbara Kordíková, PhD., PaedDr. Stanislav Kováč, PhD., RNDr. Tatiana Slováková, PhD., Mgr. Mariana Hyžná, PhD.

Last change: 26.09.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-154/25	Electrokinetic separation methods

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
course offered in summer semester only

Learning outcomes:
Aims and Objectives:
The student will become familiar with information on electromigration and electrochromatographic separations with a focus on a unified interpretation based on the classification of electroseparation techniques. The student will understand the electrophoretic concept of the mobility of ionogenic substances, and the dispersion effect applied in electrophoretic separations, the physico-chemical characterization of individual electrophoretic techniques and their analytical implementation. The student will get information about analytical, preparative and industrial applications of electroseparation principles and separation mechanisms in combined separation processes and methods. After successful completion of the education process, the student is able to solve model situations of the use of electroseparation methods carried out in capillaries and on microchips from practice, such as quality control in the analysis of technological products, bioanalytical applications, analysis of foreign substances in the environment, diagnostic and clinical analysis, forensics, etc. .

Class syllabus:
Syllabus/Indicative Content:
• Electrophoretic concept of ion mobility. Classification of electroseparation methods.
• Dispersion effects in electroseparations.
• Zone electrophoresis. Micellar electrokinetic chromatography. Electrophoretic separations in polymer solutions and in gels. Isotachophoresis. Isoelectric focusing.
• Capillary and microchip electrophoresis.
• Hydrodynamic concepts in capillary electrophoresis. Methods of suppression of hydrodynamic and electroosmotic flow.
• Factors affecting the accuracy and correctness of quantitative analysis. Methods of external standard, internal standard and standard addition.
• Analytical and preparative capillary electrophoresis. Characteristics of the separation system. Preparation of microquantities.
• Combinations of electroseparation methods (in-line, on-line and off-line modes).

• Detection techniques used in electrophoresis (electrochemical, spectral and others).
• Electroseparation of chiral substances.
• Electroseparation of proteins, DNA and biopolymers.
• Applications of capillary and microchip electrophoresis. Analysis of environmental and biological samples. New directions of development and the future of electroseparation techniques.

Recommended literature:

Suggested readings:

1. C.D. García, K.Y. Chumbimuni-Torres, E. Carrilho (Eds.), Capillary Electrophoresis and Microchip Capillary Electrophoresis: Principles, Applications, and Limitations, Wiley, 2013.
2. P. Schmitt-Kopplin (Ed.), Capillary Electrophoresis. Methods and Protocols, Humana Press, Springer, 2016.
3. C. Henry (Ed.), Microchip Capillary Electrophoresis. Methods and Protocols, Humana Press, Springer, 2006.
4. P. Boček, Capillary analytical isotachophoresis. Academia, Prague, 1987.
5. F. Foret, L. Křivánková, P. Boček, Capillary zone electrophoresis, VCH, Weinheim, 1993.

Languages necessary to complete the course:

English

Notes:

course offered in summer semester only

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Marian Masár, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAgCh/N-mCAG-168/25	General and Inorganic Chemistry

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 2 **per level/semester:** 13 / 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
There will be two written tests given during the semester (maximum 20 points each). Final exam will be a test, for which students can get maximum 60 points. For grade A, it is necessary to obtain at least 92 %, for grade B at least 84 %, for grade C at least 76 %, for grade D at least 68 % and for grade E at least 60 % of all points. Students, who will obtain less than 60 points will receive grade FX (fail).

Learning outcomes:
This course covers the background and skills needed to understand the basic principles of general and inorganic chemistry.

Class syllabus:
Molecular structure – models of chemical bonding; Lewis theory; hybridization and valence bond theory; molecular orbital theory; bond polarity; electronegativity; oxidation number; ionic bond; hydrogen-bonding; van der Waals interactions. Principles of thermodynamics: Equation of state; state functions; internal energy; enthalpy; entropy; laws of thermodynamics; thermochemical laws; spontaneous processes; states of the matter; phase – phase transitions; disperse systems – mixtures, solutions; Raoult law – colligative properties. Principles of chemical kinetics: reaction rate and order; mechanism; catalysis; chemical equilibrium. Electrolytic dissociation; acid-base theories; neutralization; pH; hydrolysis. Precipitation reactions; the solubility product. Photochemical and radical reactions. Oxidation and reduction. Elements and their basic compounds: hydrogen; group 1-2 and group 13-18 elements; d-block elements; coordination bonding; basic stereochemistry; magnetic properties; organometallic compounds.
During seminars students will solve problems related to the topics covered in the lectures and: basic nomenclature of inorganic compounds, chemical calculations related to the composition and preparation of solutions, solutions of chemical equations.

Recommended literature:
1. Duward Shriver, Peter Atkins: Inorganic Chemistry, 5th edition, 2010, Oxford University Press,
2. Stephen Lower: Chem1 virtual textbook a reference text for General Chemistry

http://www.chem1.com/acad/webtext/virtualtextbook.html

Languages necessary to complete the course:
#The course is taught in English. Recommended literature is in English.

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Erik Rakovský, PhD.

Last change: 04.02.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KGe/N-XXXX-004/21	Genetics for everyone

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2., 4.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 1482

A	B	C	D	E	FX
94,06	0,67	0,0	0,0	0,0	5,26

Lecturers: RNDr. Regina Sepšiová, PhD., doc. Mgr. Miroslava Slaninová, Dr., Mgr. Filip Červenák, PhD., prof. RNDr. Andrea Ševčovičová, PhD., doc. RNDr. Eliška Gálová, PhD., Mgr. Stanislav Kyzek, PhD., Mgr. Mária Peťková, PhD., Mgr. Ivana Kyzeková, PhD., doc. RNDr. Vladimíra Džugasová, PhD.

Last change: 15.08.2025

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KRGRR/N-XXXX-001/21	Geography of the World in the 21.st century

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 1 **per level/semester:** 13 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2., 4.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 147

A	B	C	D	E	FX
83,67	2,72	6,12	0,68	0,68	6,12

Lecturers: Mgr. Rastislav Cákoci, PhD., RNDr. Katarína Danielová, PhD., doc. RNDr. Daniel Gurňák, PhD., doc. RNDr. František Križan, PhD., doc. RNDr. Eva Rajčáková, CSc., Mgr. Michala Sládeková Madajová, PhD., RNDr. Angelika Švecová, PhD., doc. Mgr. Martin Šveda, PhD., prof. RNDr. Ladislav Tolmáči, PhD., RNDr. Mgr. Anna Tolmáči, PhD., Mgr. Gabriel Zubriczký, PhD.

Last change: 15.05.2021

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KGP/N-XXXX-007/21	Geology in Nutshell

Educational activities:
Type of activities: practicals / lecture
Number of hours:
per week: 1 / 2 **per level/semester:** 13 / 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2., 4.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 58

A	B	C	D	E	FX
89,66	0,0	0,0	0,0	8,62	1,72

Lecturers: prof. RNDr. Roman Aubrecht, Dr., prof. Mgr. Natália Hlavatá Hudáčková, PhD., doc. RNDr. Jozef Hók, CSc., doc. RNDr. Alexander Lačný, PhD., doc. RNDr. Jana Fridrichová, PhD., RNDr. Ondrej Nemec, PhD.

Last change: 20.01.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KPl/N-XXXX-009/21	Global Environmental Issues

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2., 4.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 1126

A	B	C	D	E	FX
90,5	0,0	0,27	0,0	0,0	9,24

Lecturers: doc. RNDr. Katarína Pavličková, CSc., prof. RNDr. Pavel Dlapa, PhD., doc. RNDr. Martina Zvaríková, PhD., doc. RNDr. Ľubomír Jurkovič, PhD.

Last change: 09.11.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KEM/N-mXXX-003/22	Green University 1

Educational activities:
Type of activities: practicals / seminar
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 2.., 3., 4.., 5., 6..

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 36

A	B	C	D	E	FX
94,44	0,0	0,0	0,0	0,0	5,56

Lecturers: RNDr. Jaroslav Bella, doc. Mgr. Miroslava Slaninová, Dr., Mgr. Martin Šebesta, PhD., RNDr. Hubert Žarnovičan, PhD.

Last change: 24.08.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KEM/N-mXXX-004/22	Green University 2

Educational activities:
Type of activities: practicals / seminar
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 2.., 3., 4.., 5., 6..

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 17

A	B	C	D	E	FX
94,12	0,0	0,0	0,0	0,0	5,88

Lecturers: RNDr. Jaroslav Bella, doc. Mgr. Miroslava Slaninová, Dr., Mgr. Martin Šebesta, PhD., RNDr. Hubert Žarnovičan, PhD.

Last change: 24.08.2022

Approved by: doc. RNDr. Martin Putala, CSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.KAgCh/N-CHEM-958/25	**Course title:** Inorganic Chemistry
Number of credits: 2	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: doc. RNDr. Martin Putala, CSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.LPM/N-mLPM-001/25	Introduction to chemistry of materials

Educational activities:
Type of activities: lecture
Number of hours:
per week: 3 **per level/semester:** 39
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Recommended prerequisites:
Not required but recommended: Bc. level General Chemistry; Inorganic Chemistry and/or Physical Chemistry (1) and/or Chemical Structure.

Course requirements:
Each lecture will contain multiple discussion sections of the covered topics. Participation in the discussions will represent 20% of the grade. During the semester, students will take multiple written quizzes on topics covered in the lectures. The quizzes will represent 30% of the grade. At the end of the semester, students will take the final quiz and prepare presentation on a topic related to the course. The grade for the final quiz will represent 25% of the overall grade and the grade for the presentation will represent 25% of the overall grade. Overall grading: A> 90> B> 80> C> 70> D> 60> E> 50> FX

Learning outcomes:
Objectives of the course:
The main objective of the course is to help students gain a broad understanding, where and how chemistry is used in the production, processing and development of applications of materials used in everyday life, as well as in the state-of-the-art technologies.

Class syllabus:
Abbreviated syllabus:
Introduction. What is chemistry of materials, categorization of materials, natural resources, processing, mining and extraction of raw materials building blocks
Preparation of materials. Solid-state and solution-based methods, crystallization, self-assembly, epitaxy, CVD, PVD, ALD, spin/dip-coating, other
Structure of materials. Types of solid phase interactions and bonds, ionic, metallic, covalent and molecular crystals, amorphous and crystalline materials, basics of crystallography, foams/ emulsions, quasi-crystals, liquid crystals, other
Metals and alloys. Preparation and processing, structure, categorization, corrosion, passivation, alloying, refractory metals, modern metal technologies, other

Semiconductors. Preparation and processing, structure and properties, categorization, doping, lithography, chemical etching, semiconductor photochemistry, photoelectrochemical cells, chemical sensors, other applications
Glass and ceramics. Glass chemistry, types of glass, utility and optical glass, optical fibers, oxide and non-oxide ceramics, sol-gels, aerogels, chemistry of cement and construction materials, modern ceramic technologies, other
Porous materials. Clathrates, aluminosilicates, zeolites, metal-organic-frameworks (MOFs); polyoxometalates (POMs), porous membranes, other
Carbon-based materials. Allotropes of carbon, diamond, graphite, graphene, fullerenes, carbon nanotubes, carbon fibers, other
Polymers. Polymer categorization, overview of polymer synthesis methods, chemical functionalization for specific applications, electrically conductive polymers and polymer electronics, heat-resistant and refractory polymers, impact-resistant polymers, polymeric biomaterials;
Nanomaterials. Categorization and properties of nanomaterials, quantum confinement and plasmonics, preparation of nanomaterials, top-down and bottom-up methods, colloidal syntheses, application examples, other
Superconductors. Principles of superconductivity, chemistry of superconductors, nomenclature and use in practice, other
Surface chemistry and 2D materials. Chemistry on surfaces, heterogeneous catalysis, adsorption isotherms, Langmuir-Blodget methods, adhesives, graphene, 2D materials, Mxenes, other
Materials chemistry and applications. 3D printing, self-healing and self-cleaning materials, materials for energy conversion and storage, chemistry of optical crystals, gemstones, chemistry of materials in cosmetics and food industry, chemistry of paper and textiles, other

Recommended literature:

Recommended literature:
1.Harry R. Allcock: Introduction to Materials Chemistry, 2nd Ed. Wiley 2019.
ISBN:978-1-119-34725-5
2.Bradley D. Fahlman: Materials Chemistry, 2nd. Ed., Springer 2011, ISBN 978-94-007-0693-4
3.Original literature in the field of chemistry of materials.

Languages necessary to complete the course:

#The course is taught in English. Recommended literature is in English.

Notes:

Past grade distribution

Total number of evaluated students: 2

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: RNDr. Milan Sýkora, PhD., MBA

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KFTCh/N-mCFZ-189/25	Introduction to solid state physics

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Grading: Working knowledge of mathematics, physics and physical chemistry taught in BS-level core courses. Assessment of students' knowledge will be an oral examination or test. Grade scale: A 91-100%, B 81-90 %, C 71-80 %, D 61-70 %, E 51-60 %, Fx 50 % and less.

Learning outcomes:
Objectives of the course:
The course will provide an introduction to modern solid-state theory. The student will acquire the theoretical basis necessary to understand the physical and chemical properties of materials.

Class syllabus:
Abbreviated syllabus: chemical interactions in the solid phase, crystal structure, reciprocal space, X-ray diffraction experiment, dynamics of atoms in crystals, elastic properties, thermal properties, electronic structure, electrical and magnetic properties

Recommended literature:
Recommended literature:
N. W. Ashcroft, N. D. Mermin: Solid state physics, Harcourt College Publishers 1976.
Ch. Kittel: Introduction to Solid State Physics, John Wiley & Sons, Inc.1996

Languages necessary to complete the course:
#The course is taught in English. Recommended literature is in English

Notes:

Past grade distribution
Total number of evaluated students: 1

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. Ing. Tomáš Bučko, PhD.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KFTCh/N-mCXX-005/25	Introduction to statistical thermodynamics

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Recommended prerequisites:
Working knowledge of mathematics, physics and physical chemistry taught in BS-level core courses.

Course requirements:
Assessment of students' knowledge will be an oral examination or test.
Grade scale: A 91-100%, B 81-90 %, C 71-80 %, D 61-70 %, E 51-60 %, Fx 50 % and less.

Learning outcomes:
The student will learn the principles of statistical thermodynamics: basic postulates; microcanonical, canonical, isobaric and grand canonical ensembles; partition function; quantum equilibrium ensembles; Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics; Monte Carlo and molecular mechanics methods.

Class syllabus:
- classical mechanics: Newton's laws of motion, phase space, Lagrange's formulation of classical mechanics, Legendre transformations, Hamilton's formulation of classical mechanics, the action
- theoretical foundations of statistical mechanics: laws of thermodynamics, statistical ensemble, phase space volume and Liouville's theorem, distribution function of statistical ensemble and Liouville's equation, equilibrium solutions of Liouville's equation
- microcanonical, canonical, isobaric and grand canonical statistical ensemble: basic thermodynamic relations, distribution and partition function, virial theorems, free particle, ideal gas and harmonic oscillator in different ensembles
- Monte Carlo simulations: principle of the method, central limit theorem, sampling of distributions, Markov chain, basic algorithm
- Molecular dynamics: principle of the method, basic algorithms, numerical integration of equations of motion, simulations in various statistical ensembles
- quantum equilibrium ensembles: multiparticle problem, density matrix and its time evolution, Fermi-Dirac and Bose-Einstein statistics

Recommended literature:

Statistical mechanics: Theory and molecular simulations, M. Tuckerman, Oxford university press 2010
Understanding molecular simulations, D. Frenkel and B. Smit, academic press 2002

Languages necessary to complete the course:
English

Notes:
offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. Ing. Tomáš Bučko, PhD.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-199/25	Lab-on-a-chip

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
course offered in summer semester only

Learning outcomes:
Aims and Objectives:
The student will become familiar with basic information about miniaturized analytical systems, the current state of theory, methodology, instrumentation and application of the lab-on-a-chip concept, as well as the latest trends in the field of miniaturization of analytical systems. He will understand the theory of fluid flow at the micro- and macroscale, as well as the relationship of miniaturized analytical systems and green analytical chemistry. He will learn to classify individual non-separative and separation analytical techniques from the point of view of their miniaturization. After successfully completing the education process, the student will be able to discuss the theoretical and practical aspects of miniaturized analytical systems and solve model situations of their use in the analysis of environmental and biological samples.

Class syllabus:
Syllabus/Indicative Content:
•Introduction and definition of basic terms: total analytical system (TAS), mikroTAS, "Lab-on-a-chip", miniaturized analytical systems from the point of view of the general scheme of the analytical procedure and the integration of individual steps. Portable analytical systems and their miniaturization.
•Basic aspects of miniaturized analytical systems. History, development and current status.
•Theoretical foundations of fluid flow in the micro- and macroscale, Reynolds number.
•Separation and transport of substances in miniaturized analytical systems.
•Non-separative miniaturized analytical systems: micromixers, microreactors, miniaturized flow injection analysis.
•Unified and simple characterization of electromigration, chromatographic and electrochromatographic methods and the possibility of their miniaturization.
•Characterization of dispersion processes in miniaturized analytical systems.
•Introduction to microarray electrophoresis. Defining basic concepts and transport processes.

•Electroseparation methods and their relationship with chromatographic methods. Electroseparation of biopolymers in polymer solutions and in gels on microchips. Isotachophoresis as a general analytical concentration technique in miniaturized analytical systems. Miniaturized system for isoelectric focusing in biopolymer separations.
•Possibilities of miniaturization of chromatographic methods, especially based on liquid chromatography.
•Detection techniques used in miniaturized analytical systems. Spectral techniques (based on light absorption and fluorescence) on microchips. Conductivity and electrochemical detectors. Mass spectrometry.
•Application possibilities of using miniaturized analytical systems in the analysis of environmental and biological samples.

Recommended literature:

Suggested readings:

1. J.P. Kutter: Separation Methods In Microanalytical Systems, CRC Press, 2005.
2. A. Castro, A. Escarpa, B. Simonet: Miniaturization of Analytical Systems: Principles, Designs and Applications, John Wiley & Sons, 2009.
3. C. Henry (Ed.), Microchip Capillary Electrophoresis. Methods and Protocols, Humana Press, Springer, 2006.
4. A.V. Schepdael (Ed.), Microchip Capillary Electrophoresis Protocols. Methods in Molecular Biology, Humana Press, Science+Business Media, New York, 2015.

Languages necessary to complete the course:

English

Notes:

course offered in summer semester only

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Marian Masár, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KPl/N-XXXX-008/21	Man as a part of the nature

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1., 3.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 1660

A	B	C	D	E	FX
90,72	0,3	0,0	0,0	0,06	8,92

Lecturers: doc. RNDr. Martina Zvaríková, PhD., prof. RNDr. Pavel Dlapa, PhD., RNDr. Malvína Reiffers Čierniková, PhD., prof. PaedDr. Pavol Prokop, DrSc., prof. RNDr. Peter Fedor, DrSc., prof. Ing. Eva Chmielewská, CSc., RNDr. Martin Labuda, PhD., doc. RNDr. Eva Pauditšová, PhD., RNDr. Hubert Žarnovičan, PhD., doc. RNDr. Stanislav Rapant, DrSc., doc. RNDr. Ľubomír Jurkovič, PhD., doc. Mgr. Tomáš Lánczos, PhD., doc. RNDr. Katarína Pavličková, CSc.

Last change: 09.11.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-151/25	Mass Spectrometry in analytical chemistry

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): The evaluation of the subject includes the examination of knowledge from seminars and lectures, for a maximum of 100 points. The seminar (maximum number of 40 points) includes the preparation and presentation of the seminar paper. The lecture (maximum number of 40 points) includes a final written test. The final grade includes the assessment from the final written test and the seminar. A total of at least 92 points is required to obtain an A grade, at least 84 points to obtain a B grade, at least 76 points for a C grade, at least 68 points for a D grade, and at least 60 points for an E grade.

Learning outcomes:
Aims and Objectives:
The student will become familiar with information about the status of mass spectrometry techniques in the generation of an analytical signal for chemical analysis and identification of substances. Understanding the principles of ionization, separation and detection in mass spectrometry, its possibilities in the identification of substances and its role in qualitative and quantitative analysis. He/she can interpret mass spectra from various ionization techniques and obtain relevant information from mass spectra. He/she presents solutions to assigned tasks and selected analytical problems. After completing the subject, the student is able to describe not only theoretically the principles and instrumentation of mass spectrometry, but also practically design a method for obtaining mass spectra of various chemical substances and interpreting these spectra. He/she is also able to choose a suitable combination of mass spectrometry with a separation technique for the identification and determination of various substances in simple as well as complex samples.

Class syllabus:
Syllabus/Indicative Content:
• Mass spectrometry - historical development, instrumentation, basic concepts and terminology. Chemistry of ions. Electron and proton affinities and measurement of acidity in the gas phase. Ion-molecule reactions (types, rates, transient complexes). Isotopic effects.
• Instrumentation in mass spectrometry. Sample introduction systems. Direct sample introduction.
• Ionization techniques – division and principles of ionization techniques, criteria for choosing ionization techniques, application possibilities, ambient ionization techniques.

• Mass analyzers - distribution, physical principles, application possibilities. The resolving power of the mass spectrometer. Accuracy and correctness. Calibration.
• Detection in mass spectrometry. Vacuum systems, data collection, requirements for computer technology, signal processing.
• Combination of mass spectrometry with chromatographic and electrophoretic techniques. The problems and potential of such connections. Matrix effects.
• Tandem mass spectrometry. Basic principles, basic concepts. Precursor and fragment ions. Types of fragmentation. Tandem and hybrid mass analyzers. Types of work modes and possibilities of their use in the analysis of real samples.
• Qualitative and quantitative analysis. Different ways of evaluating the obtained data.
• Targeted and untargeted analysis. Multivariate data analysis. Applications.
• Interpretation of mass spectra obtained by different ionization techniques. Mass spectrum, its origin and description. Basic fragmentation rules.
• Use of mass spectrometry in analytical chemistry, its application potential in various fields of science and technology.
Seminars:
• Interpretation of mass spectra obtained by hard ionization techniques. Mass spectrum, its origin and description. Searching for a molecular ion in the spectrum and obtaining the molecular weight of the substance from the spectrum. Estimation of the elemental composition of a molecular ion. Basic fragmentation rules.
• Interpretation of mass spectra obtained by soft ionization techniques. Mass spectrum, its origin and description. Searching for a molecular ion in the spectrum and obtaining the molecular weight of the substance from the spectrum. Estimation of the elemental composition of a molecular ion. Tandem mass spectrometry.
• Interpretation of mass spectra. Examples of mass spectra of various types of substances, their interpretation. Interpretation of unknown spectra.

Recommended literature:
Suggested readings:
1. J.H. Gross, Mass Spectrometry - A Textbook, 2. vyd., Springer 2011.
2. R. Ekman, Mass Spectrometry, Instrumentation, Interpretation, and Applications, J. Wiley Sons, 2009.
3. F.W. McLafferty, F. Tureček, Interpretation of Mass Spectra,4. vyd., University Science Book, Mill Valley, CA, USA, 1993.
4. E. de Hoffmann, V. Stroobant, Mass Spectrometry Principles and Applications, 3. vyd., Chichester: Wiley-Intersciences, 2007.
5. Ch.G. Herbert, R A.W. Johnstone, Mass spectrometry Basics, 1. vyd., Boca Raton, CRC Press, 2004.

Languages necessary to complete the course:
English

Notes:
course offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Andrea Vojs Staňová, PhD.

Last change: 20.01.2026
Approved by: doc. RNDr. Martin Putala, CSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.LPM/N-CHEM-957/25	**Course title:** Materials chemistry
Number of credits: 3	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: doc. RNDr. Martin Putala, CSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-178/25	Materials organic chemistry

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 4.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): Written exam followed by oral consultation of the results. To obtain an A rating it is necessary to obtain on average at least 90% of points, to obtain a B rating at least 80% points, to a C rating at least 70% points, to a D rating at least 60% points and to an E rating at least 50% points. Credits will not be awarded to a student who scores less than 50% of the points.

Learning outcomes:
The student will get a overview of the use of organic compounds in modern material applications, based mainly on the properties of individual organic molecules, especially their interaction with an electric field or electromagnetic radiation. Emphasis is placed on understanding the principle of individual applications and the relationship between the structure of organic compounds and the properties enabling these applications. The student should be able to explain these principles and apply them to particular examples based on the provided structures of compounds.

Class syllabus:
1) Introduction to nanotechnology.
2) Organic electronics (conductors and molecular wires, superconductors, semiconductors, transistors, rectifiers).
3) Organic photoelectronics (devices for electron and electronic energy transfer and processing: switches, antennae, solar and fuel cells).
4) Laser and visualization technologies (materials with nonlinear optical properties, liquid crystals, organic light emitting diodes).
5) Molecular computing: memories and logic gates.
6) Molecular machines: mechanical movement at molecular level (rotors, clefts, pumps, linear motors).

Recommended literature:
1) V. Balzani, M. Venturi, A. Credi: Molecular Devices and Machines (A Journey into the Nanoworld), Wiley-VCH, Weinheim, 2003.
2) Reviews from scientific journals.

Languages necessary to complete the course:
English

Notes:
offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Martin Putala, CSc.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAgCh/N-mCAG-165/25	Materials photochemistry

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Seminars are evaluated at the end of the semester. From 100 pts that the student can get during the overall evaluation, a maximum of 20 pts is from the seminar evaluation where the student will prepare a seminar work along with a final short presentation on a selected topic. These seminar topics will be introduced by the lecturer during the first week of the semester and one topic will be assigned to each student. The student will submit the seminar work no later than the last day of the teaching part of the semester. The submission of the seminar work is a condition to take the written examination. The written examination will be based on the content of lectures and the student can obtained a maximum of 80 pts. The final grade is determined according to the following scale: A - at least 92 points, B - at least 84 points, C - at least 76 points, D - at least 68 points, E - at least 60 points.

Learning outcomes:
Objectives of the course:
The aim of the course is to learn about materials photochemistry, including the basic principles of photochemistry and photochemistry of materials. The lectures will provide a detailed introduction to the use of materials in photochemical processes present in technological, energy and environmental applications. In the seminars, students will have the opportunity to work on a mini-project based on a selected topic. They will have to look for literature with the assistance of the teachers on a specific photochemical thematic, analyze it and prepare a seminar work and a structured oral presentation.

Class syllabus:
Abbreviated syllabus:
1. Basic principles of photochemistry I: What is light? Introduction to photophysical processes; particularity of photochemical labs (both analysis and synthesis)
2. Basic principles of photochemistry II: structure of atoms/molecules, energy levels, absorption, Lambert-Beer law, selection rules, type of electronic transitions
3. Molecular photochemistry: Luminescence, Jablonski diagram, intersystem crossing, singlet vs triplet photosensitizers, phosphorescence, bioimaging, singlet oxygen production.

4. Nonlinear optical (NLO) materials: NLO effects, second-harmonic generation, terahertz wave generation, two-photon absorption, two-state model, three-state model, inorganic, organic and organometallic systems displaying NLO, structure-property relationships.
5. Energy applications of photochemistry I: Photovoltaics, thin-film solar cells, single-junction and multi-junction systems, perovskite solar cells, sensitized solar cells
6. Energy applications of photochemistry II: Photosynthesis, artificial photosynthesis, photochemistry at semiconductor/liquid interfaces, photoelectrochemical cells, other semiconductor/liquid junction applications
7. Energy applications of photochemistry III: fuel cells and solar oxide fuel cells (SOFCs)
8. Heterogeneous photocatalysis: what is photocatalysis? Semiconductor photocatalysis; Pros & Cons; How to improve photocatalysis?
9. Heterogeneous photo-Fenton: what is Fenton reaction? Concepts & Limitations; How to improve photo-Fenton?
10. Environmental application of photochemistry I: photoactive materials for water treatment and soil remediation
11. Environmental application of photochemistry II: photoactive materials for CO2 conversion, NOx decomposition, and H2 production
12. Oral presentations

Recommended literature:

Recommended literature:
1) Applied Photochemistry. R. C. Evans, P. Douglas, H. D. Burrows (Eds). Dordrecht, Springer, 2013. ISBN 978-90-481-3830-2.
2) Environmental Photochemistry. Pierre Boule (Ed.). Dordrecht, Springer, 1999. ISBN 978-3-540-69044-3.
3) Photochemistry, Past Present and Future. Angelo Albini (Ed.). Dordrecht, Springer, 2016. ISBN 978-3-662-47977-3

Languages necessary to complete the course:

Recommended literature:
1) Applied Photochemistry. R. C. Evans, P. Douglas, H. D. Burrows (Eds). Dordrecht, Springer, 2013. ISBN 978-90-481-3830-2.
2) Environmental Photochemistry. Pierre Boule (Ed.). Dordrecht, Springer, 1999. ISBN 978-3-540-69044-3.
3) Photochemistry, Past Present and Future. Angelo Albini (Ed.). Dordrecht, Springer, 2016. ISBN 978-3-662-47977-3

Notes:

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. Mgr. Olivier Monfort, PhD., Mgr. Peter Hrobárik, PhD., Mgr. Martin Motola, PhD., RNDr. Milan Sýkora, PhD., MBA

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAgCh/N-mCAG-167/25	Materials photochemistry

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Seminars are evaluated at the end of the semester. From 100 pts that the student can get during the overall evaluation, a maximum of 20 pts is from the seminar evaluation where the student will prepare a seminar work along with a final short presentation on a selected topic. These seminar topics will be introduced by the lecturer during the first week of the semester and one topic will be assigned to each student. The student will submit the seminar work no later than the last day of the teaching part of the semester. The submission of the seminar work is a condition to take the written examination. The written examination will be based on the content of lectures and the student can obtained a maximum of 80 pts. The final grade is determined according to the following scale: A - at least 92 points, B - at least 84 points, C - at least 76 points, D - at least 68 points, E - at least 60 points.

Learning outcomes:
The aim of the course is to learn about materials photochemistry, including the basic principles of photochemistry and photochemistry of materials. The lectures will provide a detailed introduction to the use of materials in photochemical processes present in technological, energy and environmental applications. In the seminars, students will have the opportunity to work on a mini-project based on a selected topic. They will have to look for literature with the assistance of the teachers on a specific photochemical thematic, analyze it and prepare a seminar work and a structured oral presentation.

Class syllabus:
Abbreviated syllabus:
1. Basic principles of photochemistry I: What is light? Introduction to photophysical processes; particularity of photochemical labs (both analysis and synthesis)
2. Basic principles of photochemistry II: structure of atoms/molecules, energy levels, absorption, Lambert-Beer law, selection rules, type of electronic transitions
3. Molecular photochemistry: Luminescence, Jablonski diagram, intersystem crossing, singlet vs triplet photosensitizers, phosphorescence, bioimaging, singlet oxygen production.
4. Nonlinear optical (NLO) materials: NLO effects, second-harmonic generation, terahertz wave generation, two-photon absorption, two-state model, three-state model, inorganic, organic and organometallic systems displaying NLO, structure-property relationships.

5. Energy applications of photochemistry I: Photovoltaics, thin-film solar cells, single-junction and multi-junction systems, perovskite solar cells, sensitized solar cells
6. Energy applications of photochemistry II: Photosynthesis, artificial photosynthesis, photochemistry at semiconductor/liquid interfaces, photoelectrochemical cells, other semiconductor/liquid junction applications
7. Energy applications of photochemistry III: fuel cells and solar oxide fuel cells (SOFCs)
8. Heterogeneous photocatalysis: what is photocatalysis? Semiconductor photocatalysis; Pros & Cons; How to improve photocatalysis?
9. Heterogeneous photo-Fenton: what is Fenton reaction? Concepts & Limitations; How to improve photo-Fenton?
10. Environmental application of photochemistry I: photoactive materials for water treatment and soil remediation
11. Environmental application of photochemistry II: photoactive materials for CO2 conversion, NOx decomposition, and H2 production
12. Oral presentations

Recommended literature:

1) Applied Photochemistry. R. C. Evans, P. Douglas, H. D. Burrows (Eds). Dordrecht, Springer, 2013. ISBN 978-90-481-3830-2.
2) Environmental Photochemistry. Pierre Boule (Ed.). Dordrecht, Springer, 1999. ISBN 978-3-540-69044-3.
3) Photochemistry, Past Present and Future. Angelo Albini (Ed.). Dordrecht, Springer, 2016. ISBN 978-3-662-47977-3

Languages necessary to complete the course:

#The course is taught in English. Recommended literature is in English.

Notes:

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. Mgr. Olivier Monfort, PhD., Mgr. Peter Hrobárik, PhD., Mgr. Martin Motola, PhD., RNDr. Milan Sýkora, PhD., MBA

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-171/25	Medicinal chemistry – drug design

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): Grades will be based on the results of seminar (activity and accomplishment of homeworks, weight 0.4) and written test focused on understanding of principles of Medicinal chemistry (weights 0.6). More than 50% of points must be obtained from each part of the grading.
The course has a standardized grading system which is identified below:
A (91 – 100%): Outstanding, excellent work (exceptional performance with strong evidence of original thinking and obvious capacity to analyze, synthesize and evaluate. B (81 – 90 %): Good, competent work; laudable performance with evidence of some original thinking, good problem-solving ability, exhibiting a serious, responsible engagement with the course content. C (71 – 80%): Adequate, reasonably satisfactory work; fair performance but infrequent evidence of original thinking or the capacity to analyze, satisfies the minimum requirements of the course. D (61 – 70%): Less acceptable work; relatively weak performance with little evidence of original thinking or ability to analyze or synthesize course material. E (51 – 60%): Minimally acceptable work; very weak performance with little evidence of original thinking, showing inadequate grasp of some basic elements of the course. Fx (under 50%): Inadequate work; poor performance that indicates a lack of understanding or misunderstanding of essential subject matter.

Learning outcomes:
Aims and Objectives:
This course provides an overview of the basics of Medicinal Chemistry in terms of drug development, behavior, and fate of drugs in the body.
At the end of this course, students should have:
• general knowledge about the drug development process, properties of drugs and their fate in the body included
• experiences with the analysis and presentation of scientific interdisciplinary articles and literature focused on properties of biological targets, the development and properties of drugs, their screening and investigation of their properties in the biological environment

Class syllabus:
Syllabus/Indicative Content:

1) Introduction to the Medicinal chemistry. Understanding of basic terms, information sources and databases, intermolecular interactions in drug - target complex and its analysis and understanding of basic principles in drug development process. Understanding of mechanism of drug treatment.
2) Pharmacokinetic ADME/TOX properties of biologically active compounds.
3) Pharmacodynamic properties, activity and selectivity of target modulators, drug candidates or drugs.
4) Drug polyvalency and modern methods for drug development in the presence of biological target.

Recommended literature:
Suggested readings:
Graham L. Patrick An Introduction to Medicinal Chemistry, Seventh Edition, Oxford University Press, 2023.

Languages necessary to complete the course:
English

Notes:
offered in winter semester only, number of students is based on regular number of 2nd (MSc) degree students in Organic Chemistry + max 5 other students

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Andrej Boháč, CSc.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.KOrCh/N-CHEM-951/25	**Course title:** Molecular materials
Number of credits: 1	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: doc. RNDr. Martin Putala, CSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAgCh/N-mCXX-006/25	Molecular modeling

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 2 **per level/semester:** 13 / 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Students will prepare protocols from individual computer-aided modelling experiments. The obtained results and the level of data processing will be evaluated. The condition for participation in the exam is to obtain at least 60 out of 100 possible points from all exercises. The exam consists of a written test, in which a total of 100 points can be obtained. The final grade is calculated as an average from the evaluation of the exam and the exercises.
The final grade is determined according to the following scale: A - at least 92 points, B - at least 84 points, C - at least 76 points, D - at least 68 points, E - at least 60 points.

Learning outcomes:
By completing the course, the students gain a comprehensive overview of using contemporary quantum-chemical (QCH) methods of theoretical chemistry in organic, inorganic and organometallic chemistry experiments, including modern density functional theory (DFT) with non-relativistic and relativistic Hamiltonian, the post-Hartree-Fock methods, electron and molecular dynamics, and band structures in crystalline solids. Students will understand the theoretical foundations of the QCH methods, the approximations behind them and will be able to estimate the suitability of the methods and their limits when applying them to solve frequent questions in inorganic, organic and organometallic chemistry. Using theoretical methods, students will learn how to calculate and interpret various physicochemical properties of molecular systems, such as linear and non-linear optical properties, magnetic properties (NMR, EPR) or absorption spectra (UV-vis-NIR, IR), and how to rationally design materials with specific properties and tailor them at the molecular level. Students will also learn to study the course of a chemical reaction based on the theory of the transit state and to estimate the effect of solvent/matrix and relativistic effects on properties of given system. Graduates of this subject will be able to apply the acquired skills to complex problems solved in the laboratory - from defining a theoretical problem to choosing an appropriate QCH method and performing the calculations themselves to evaluating the results.

Class syllabus:
Lectures are supplemented by independent solving the practical problems in chemistry by students. Practical teaching devoted to topics from lectures takes place using modern quantum-chemical programs (Orca, ReSpect, Gaussian) on a computing cluster.

1. Summary of basic concepts of quantum chemistry I: Schrödinger equation, Born-Oppenheimer approximation, variational principle, Slater determinant, LCAO. Overview of computational quantum-chemical methods: DFT vs post-HF methods.
2. Summary of basic concepts of quantum chemistry II: atomic basis sets, DFT functionals, solvent models. Input syntax to QCH programs and introduction to the Linux operation system.
3. Structure optimizations and calculation of thermochemical data.
4. Searching for transition states, Eyring equation, localization of critical points on PES (reactants, products, intermediates, transition states), kinetic isotope effect, limits of transition state theory.
5. Chemical-bond analysis and non-covalent interactions.
6. Prediction and interpretation of UV-vis absorption and emission spectra, X-ray absorption spectra and natural chiroptical properties (ORD, ECD).
7. Prediction and interpretation of electric properties (linear and non-linear optical responses).
8. Prediction and interpretation of magnetic resonance spectra (EPR, NMR, pNMR) and parameters (g-shifts, chemical shifts, J-coupling constants, etc.).
9. Relativistic effects in chemistry and spectroscopy.
10. Molecular dynamics and Boltzmann averaging.
11. Real-time electron dynamics and direct light-matter interactions.
12. Solid-state chemistry and simulating band structures.

Recommended literature:

F. Jensen, Introduction to Computational Chemistry, 3rd Edition, Wiley, 2017.
P. Atkins, R. Friedman, Molecular Quantum Mechanics, 5th Edition, Oxford University Press, 2010.
C. J. Cramer, Essentials of Computational Chemistry, 2nd Edition, Wiley, 2004.

Languages necessary to complete the course:
English

Notes:
offered in the winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Peter Hrobárik, PhD., Mgr. Michal Repiský, PhD.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.LPM/N-mLPM-002/25	Nanostructured materials

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Recommended prerequisites:
Recommended: Introduction to Materials Chemistry, structure of solids.

Course requirements:
Grading: Each lecture will contain multiple discussion sections of the covered topics. Participation in the discussions will represent 20% of the grade. During the semester, students take multiple written quizzes on topics covered in the lectures. The quizzes will represent 30% of the grade. At the end of the semester, students will prepare presentation on a topic related to the course. The grade for the presentation will represent 50% of the final grade. Overall grading: A> 90> B> 80> C> 70> D> 60> E> 50> FX

Learning outcomes:
Objectives of the course:
Students will learn what are nanomaterials, how are they categorized, how are they prepared, what are their properties and known applications.

Class syllabus:
Abbreviated syllabus:
Introduction, definitions, categorization, 0D, 1D and 2D nanomaterials, inorganic nanomaterials, organic and bio-nanomaterials, nano-heterostructures, photonic and nanostructured materials, nanomaterials preparation, top-down, bottom-up methods, colloidal syntheses, nanomaterials characterization methods, quantum-confinement and plasmonic effects in nanomaterials, optical, electrical and magnetic properties, examples of nanomaterials applications.

Recommended literature:
Original literature in the field of chemistry of materials.

Languages necessary to complete the course:
#The course is taught in English. Recommended literature is in English.

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: RNDr. Milan Sýkora, PhD., MBA

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-152/25	Optical methods in analytical chemistry

Educational activities:
Type of activities: practicals / lecture
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): The evaluation of the subject includes the verification of knowledge from laboratory practice and lectures, for a maximum of 100 points. The laboratory practice (maximum number of 40 points) includes examinations from preparation for exercises, active participation in exercises, results of experimental work summarized in protocols and a final written examination. The lecture (maximum number of 60 points) includes a final written test. The final grade includes the assessment from the final written test and laboratory practice. A total of at least 92 points is required to obtain an A grade, at least 84 points to obtain a B grade, at least 76 points for a C grade, at least 68 points for a D grade, and at least 60 points for an E grade. The evaluation is identical even for the distance form of education.

Learning outcomes:
Aims and Objectives:
The student will become familiar with information about the staus of optical methods in the system of gathering the scientific knowledge, their essential need for the detection and identification of various substances and the generation of an analytical signal. The student will understand the analytical and industrial applications of the principles of various optical methods. Can classify and characterize different optical methods. He/she can perform various calculations in the field of optical methods and solve model situations from practice.

Class syllabus:
Syllabus/Indicative Content:
• Theoretical foundations of optical methods. Properties of electromagnetic radiation. Interaction of radiation and particles. Wave nature of electromagnetic radiation. Origin and regularities of optical atomic and molecular spectra.
• Experimental basics of optical methods. Classification of optical methods.
• Atomic absorption spectrometry; direct analysis of solid samples; generation and atomization of volatile compounds; analytical use.
• Atomic emission spectrometry; excitation of emission spectra; instrumentation; sample introduction; radiation detectors; analytical use.

• UV-Vis spectrometry; formation of the electronic spectrum; parameters affecting radiation absorbance; experimental setup; identification of the structure of substances; determination of elements and compounds.
• Fluorescence spectrometry; emergence of photoluminescence spectra; structure of substances and fluorescence; fluorescence quenching; fluorescence flux density; experimental setup; analytical use.
• Infrared spectrometry; emergence of vibrational-rotational spectra; basic division of infrared regions; experimental setup; identification of substances.
• Raman spectrometry; emergence of Raman spectra; Raman shift; vibrational behavior of substances; Raman vs. infrared spectrum; analytical use.
• Non-spectral optical methods; distribution of non-spectral optical methods; polarization of light; chirality of substances; analytical use of polarimetry.
• Dynamic light scattering; a technique for measuring the particle size of molecules; principle of measurement, experimental arrangement and analytical use.
• Validation of analytical methods with a focus on optical methods of chemical analysis.
• Solving problems from various areas of social and production practice and the use of optical methods in analytical procedures and industrial procedures (case studies). Use of optical methods in selected areas of social practice (clinical diagnostics, control of environmental components, food quality control, pharmaceutical and biotechnological applications) .
• Trends in the development of optical methods in analytical chemistry.
Laboratory practice
• Atomic absorption spectrometry with flame atomization.
• Atomic absorption spectrometry with electrothermal atomization.
• Atomic absorption spectrometry with hydride generation.
• Molecular absorption spectrometry.
• Infrared spectrometry.

Recommended literature:
Suggested readings:
1. J.C. Lindon: Encyclopedia of Spectroscopy and Spectrometry, Academic Press, 2010.

Languages necessary to complete the course:
English

Notes:
course offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Radoslav Halko, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.KOrCh/N-CHEM-952/25	**Course title:** Organic chemistry
Number of credits: 2	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: doc. RNDr. Martin Putala, CSc.	

COURSE DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.KOrCh/N-mCOR-175/25	**Course title:** Organic photochemistry and electrochemistry
Educational activities: **Type of activities:** lecture **Number of hours:** **per week:** 2 **per level/semester:** 26 **Form of the course:** on-site learning	
Number of credits: 2	
Recommended semester: 4.	
Educational level: II.	
Prerequisites:	
Course requirements: The final grade is based on final written and oral exam. Grade scale: A 85%-100%, B 75%-85%, C 75%-70%, D 70%-65%, E 65%-60%, Fx 60% and less.	
Learning outcomes: Students will gain theoretical mastery of photochemistry and electrochemistry of organic compounds. They will be able to understand qualitative as well as quantitative behavior of excited state dynamics, and follow-up processes. Students will be capable to predict photo- and electro-chemical properties based on chemical structure and design molecules with desired parameters. Gained skills combine organic and physical chemistry theoretical background with molecular spectroscopy, allowing for rational design of photo- and electro-chemical reactions in biological systems and materials chemistry. Students will be able to understand basic electrochemical terminology used in organic chemistry. They will be able to apply organic electrochemistry as a tool in reaction mechanism elucidation as well as a tool for synthesis. Students will gain knowledge of currently used industrial processes using photo- and electro-chemistry, and will be able to identify problems with upscaling lab-scale experiments. As a result, students will be able to co-operate on interdisciplinary projects, and communicate with professionals in the fields of photochemistry and electrochemistry.	
Class syllabus: Syllabus/Indicative Content: 1. QUANTUM YIELD, RATE OF PHOTOCHEMICAL REACTIONS: differential quantum yield, quantum yield vs. rate of reactions, chemical actinometry 2. FLUORESCENCE: structure-activity relationships, basic fluorophore overview, quantification of fluorescent behaviour (quantum yield determination – using standards, integration sphere, lifetime, Raman bands) 3. FLUORESCENT TAGS: biological applications – free rotor effect (Förster-Hoffmann equation); PET and FRET mechanisms in biological applications: structure-activity relationships, quantitative behaviours.	

4. PHOTOCHEMISTRY OF ALKENE AND DIAZO COMPOUNDS: Photoisomerizations; photocyclizations; formation of systems with large internal strain; photochromism, molecular switches
5. PHOTOCHEMISTRY OF CARBONYLS: Photofragmentations (Norrish I); photoadditions (Norrish II); intermolecular HAT by a C=O group; cycloadditions and photoenolization
6. PHOTOREDUCTIONS AND PHOTOELIMINATONS: photochemistry of nitrobenzyl derivatives; photoelimination of N2 (diazo compounds, diaziridines, azides); photodeprotection of protective groups.
7. PHOTOOXIDATIONS AND PHOTOSUBSTITUTIONS: oxidative processes driven by light; photosubstitutions on aromatic core.
8. PHOTOSENSITIZATION and EDA COMPLEXES: photosensitizers and mechanisms of photosensitization; photosensitized cyclizations, isomerizations and dual catalytic processes, formation of singlet oxygen and its applications to synthesis; EDA complexes in synthesis – simple applications, use of auxiliary groups and EDA catalytic intermediates
9. PHOTO-REDOX CATALYSIS: mechanisms of photo-redox catalysis; phosphorescence quenching; organic and metal-based photo-redox catalysts; net reductive/oxidative processes and redox-neutral processes; dual redox catalysis; TTA and conPET processes in catalysis; photo-redox catalysis using heterogeneous catalysts; methods of mechanism elucidation in photo-redox catalysis.
10. INTRODUCTION TO ELECTROCHEMISTRY: physico-chemical theory of electrochemical processes (Nernst equation, Faraday equation, Butler-Volmer equation); diffusion phenomena; analytical methods in study of organic reactions– cyclic voltammetry; practical design of electrochemical cells, electrodes and electrolytes; galvanostatic and potentiostatic electrolysis
11. ELECTROSYNTHESIS: electrooxidations; electroreductions; recombination of radicals at electrodes; umpolung and selectivity of electrochemical reactions; auxiliary groups;“cation pool“ methods; mediators
12. INDUSTRIAL APPLICATIONS OF ORGANIC PHOTO- AND ELECTRO-CHEMISTRY:Design of industrial photo- and electro-chemical reactors; photochemical processes: radical chlorinations, Toray process; vitamin D3 synthesis, photooxygenations, degradation of pollutants; electrochemical reactions: overview of inorganic processes, Monsanto process (adiponitrile), electrooxidations, electrofluorinations, use of mediators.
13. PHOTO-ELECTROCATALYSIS AND EMERGENT TECHNOLOGIES: photo-electrocatalysis: design of catalysts and catalytic systems; photoelectrodes; electrochemically-mediated photo-redox catalysis; decoupled photo-electrochemistry; emergent technologies in photo- and electro-chemistry: flow reactors, high-throughput screening; machine-learning and 3D printing.

Recommended literature:

Suggested readings:
ANSLYN E.V., DOUGHERTY D.A.: Modern Physical Organic Chemistry, University Science Books, Herndon 2006, ISBN 978-1-891389-31-3.
KLÁN P., WIRZ J.: Photochemistry of Organic Compounds: From Concepts to Practice. John Wiley & Sons Ltd, Chichester 2009, ISBN 978-1-4051-9088-6.
VALEUR B.: Molecular Fluorescence: Principles and Applications, Wiley-VCH Verlag GmbH, Weinheim, 2001, ISBN 3-527-60024-8.
FUCHIGAMI T., ATOBE M., INAGI S.: Fundamentals and Applications of Organic Electrochemistry Synthesis: Materials, Devices, John Wiley & Sons Ltd, Chichester 2015, ISBN 978-1-118-65317-3
HAMMERICH O., SPEISER B.: Organic Electrochemistry: Revised and Explained, CRC Press, Boca Raton 2016, ISBN 978-1-4200-8402-3

Languages necessary to complete the course:
English

Notes:
offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Ing. Michal Májek, PhD., RNDr. Marek Cigáň, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-179/25	Organic photochemistry and electrochemistry

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 4.

Educational level: II.

Prerequisites:

Course requirements:
The final grade is based on final written and oral exam. Grade scale: A 85%-100%, B 75%-85%, C 75%-70%, D 70%-65%, E 65%-60%, Fx 60% and less.

Learning outcomes:
Aims and Objectives:
Students will gain theoretical mastery of photochemistry and electrochemistry of organic compounds. They will be able to understand qualitative as well as quantitative behavior of excited state dynamics, and follow-up processes. Students will be capable to predict photo- and electro-chemical properties based on chemical structure and design molecules with desired parameters. Gained skills combine organic and physical chemistry theoretical background with molecular spectroscopy, allowing for rational design of photo- and electro-chemical reactions in biological systems and materials chemistry. Students will be able to understand basic electrochemical terminology used in organic chemistry. They will be able to apply organic electrochemistry as a tool in reaction mechanism elucidation as well as a tool for synthesis. Students will gain knowledge of currently used industrial processes using photo- and electro-chemistry, and will be able to identify problems with upscaling lab-scale experiments. As a result, students will be able to co-operate on interdisciplinary projects, and communicate with professionals in the fields of photochemistry and electrochemistry.

Class syllabus:
Syllabus/Indicative Content:
1. QUANTUM YIELD, RATE OF PHOTOCHEMICAL REACTIONS: differential quantum yield, quantum yield vs. rate of reactions, chemical actinometry
2. FLUORESCENCE: structure-activity relationships, basic fluorophore overview, quantification of fluorescent behaviour (quantum yield determination – using standards, integration sphere, lifetime, Raman bands)
3. FLUORESCENT TAGS: biological applications – free rotor effect (Förster-Hoffmann equation); PET and FRET mechanisms in biological applications: structure-activity relationships, quantitative behaviours.

4. PHOTOCHEMISTRY OF ALKENE AND DIAZO COMPOUNDS: Photoisomerizations; photocyclizations; formation of systems with large internal strain; photochromism, molecular switches
5. PHOTOCHEMISTRY OF CARBONYLS: Photofragmentations (Norrish I); photoadditions (Norrish II); intermolecular HAT by a C=O group; cycloadditions and photoenolization
6. PHOTOREDUCTIONS AND PHOTOELIMINATONS: photochemistry of nitrobenzyl derivatives; photoelimination of N2 (diazo compounds, diaziridines, azides); photodeprotection of protective groups.
7. PHOTOOXIDATIONS AND PHOTOSUBSTITUTIONS: oxidative processes driven by light; photosubstitutions on aromatic core.
8. PHOTOSENSITIZATION and EDA COMPLEXES: photosensitizers and mechanisms of photosensitization; photosensitized cyclizations, isomerizations and dual catalytic processes, formation of singlet oxygen and its applications to synthesis; EDA complexes in synthesis – simple applications, use of auxiliary groups and EDA catalytic intermediates
9. PHOTO-REDOX CATALYSIS: mechanisms of photo-redox catalysis; phosphorescence quenching; organic and metal-based photo-redox catalysts; net reductive/oxidative processes and redox-neutral processes; dual redox catalysis; TTA and conPET processes in catalysis; photo-redox catalysis using heterogeneous catalysts; methods of mechanism elucidation in photo-redox catalysis.
10. INTRODUCTION TO ELECTROCHEMISTRY: physico-chemical theory of electrochemical processes (Nernst equation, Faraday equation, Butler-Volmer equation); diffusion phenomena; analytical methods in study of organic reactions– cyclic voltammetry; practical design of electrochemical cells, electrodes and electrolytes; galvanostatic and potentiostatic electrolysis
11. ELECTROSYNTHESIS: electrooxidations; electroreductions; recombination of radicals at electrodes; umpolung and selectivity of electrochemical reactions; auxiliary groups;“cation pool“ methods; mediators
12. INDUSTRIAL APPLICATIONS OF ORGANIC PHOTO- AND ELECTRO-CHEMISTRY:Design of industrial photo- and electro-chemical reactors; photochemical processes: radical chlorinations, Toray process; vitamin D3 synthesis, photooxygenations, degradation of pollutants; electrochemical reactions: overview of inorganic processes, Monsanto process (adiponitrile), electrooxidations, electrofluorinations, use of mediators.
13. PHOTO-ELECTROCATALYSIS AND EMERGENT TECHNOLOGIES: photo-electrocatalysis: design of catalysts and catalytic systems; photoelectrodes; electrochemically-mediated photo-redox catalysis; decoupled photo-electrochemistry; emergent technologies in photo- and electro-chemistry: flow reactors, high-throughput screening; machine-learning and 3D printing.

Recommended literature:

Suggested readings:
ANSLYN E.V., DOUGHERTY D.A.: Modern Physical Organic Chemistry, University Science Books, Herndon 2006, ISBN 978-1-891389-31-3.
KLÁN P., WIRZ J.: Photochemistry of Organic Compounds: From Concepts to Practice. John Wiley & Sons Ltd, Chichester 2009, ISBN 978-1-4051-9088-6.
VALEUR B.: Molecular Fluorescence: Principles and Applications, Wiley-VCH Verlag GmbH, Weinheim, 2001, ISBN 3-527-60024-8.
FUCHIGAMI T., ATOBE M., INAGI S.: Fundamentals and Applications of Organic Electrochemistry Synthesis: Materials, Devices, John Wiley & Sons Ltd, Chichester 2015, ISBN 978-1-118-65317-3
HAMMERICH O., SPEISER B.: Organic Electrochemistry: Revised and Explained, CRC Press, Boca Raton 2016, ISBN 978-1-4200-8402-3

Languages necessary to complete the course:
English

Notes:
offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Ing. Michal Májek, PhD., RNDr. Marek Cigáň, PhD.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-174/25	Organic reaction mechanisms

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 3 / 1 **per level/semester:** 39 / 13
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The course evaluation is based on a written test comprising of writing products and mechanisms of a series or organic reactions on topics discussed during the course. The course has a standardized grading system which is identified below:
A (92 – 100%): Outstanding, excellent work (exceptional performance with strong evidence of original thinking and obvious capacity to analyze, synthesize and evaluate. B (84 – 91 %): Good, competent work; laudable performance with evidence of some original thinking, good problem-solving ability, exhibiting a serious, responsible engagement with the course content. C (76 – 83%): Adequate, reasonably satisfactory work; fair performance but infrequent evidence of original thinking or the capacity to analyze, satisfies the minimum requirements of the course. D (68 – 75%): Less acceptable work; relatively weak performance with little evidence of original thinking or ability to analyze or synthesize course material. E (60 – 67%): Minimally acceptable work; very weak performance with little evidence of original thinking, showing inadequate grasp of some basic elements of the course. Fx (under 60%): Inadequate work; poor performance that indicates a lack of understanding or misunderstanding of essential subject matter.

Learning outcomes:
Aims and Objectives:
The aim of the course is to show and explain to students the principles of mechanisms of basic types of organic reactions. After completing the subject, the students should be able to understand all organic reactions, which will enable them to creatively solve problems in organic synthesis, material chemistry, organic catalysis, bioorganic and medicinal chemistry.

Class syllabus:
Syllabus/Indicative Content:
1) Nucleophilic substitutions on sp3 carbons; 2) nucleophilic substitutions on sp2 carbons; 3) electrophilic and radical substitutions on sp3 carbons; 4) elimination reactions; 5) additions carbon-carbon multiple bonds; 6) seminar – solving mechanistic assignments; 7) electrophilic aromatic substitutions; 8) nucleophilic and radical aromatic substitutions; 9) nucleophilic additions C-heteroatom multiple bonds; 10) nucleophilic additions to activated carbon-carbon multiple bonds,

chemistry of enolates; 11) nucleophilic and electrophilic molecular rearrangements, synthetically important cycloadditions; 12) seminar – solving mechanistic assignments.

Recommended literature:
Suggested readings:
1. R. Brückner, M. Harmata, P. A. Wender, Organic mechanisms: reactions, stereochemistry and synthesis, Springer, 2010; 2. E. V. Anslyn, D. A. Dougherty, Modern physical organic chemistry, University Science, 2006; 3. J. Clayden, N. Greeves, S. Warren, P. Wothers, Organic Chemistry, Oxford University Press, 2000.

Languages necessary to complete the course:
English

Notes:
offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. Mgr. Radovan Šebesta, DrSc.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-180/25	Organic reaction mechanisms

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 3 / 1 **per level/semester:** 39 / 13
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The course evaluation is based on a written test comprising of writing products and mechanisms of a series or organic reactions on topics discussed during the course. The course has a standardized grading system which is identified below:
A (92 – 100%): Outstanding, excellent work (exceptional performance with strong evidence of original thinking and obvious capacity to analyze, synthesize and evaluate. B (84 – 91 %): Good, competent work; laudable performance with evidence of some original thinking, good problem-solving ability, exhibiting a serious, responsible engagement with the course content. C (76 – 83%): Adequate, reasonably satisfactory work; fair performance but infrequent evidence of original thinking or the capacity to analyze, satisfies the minimum requirements of the course. D (68 – 75%): Less acceptable work; relatively weak performance with little evidence of original thinking or ability to analyze or synthesize course material. E (60 – 67%): Minimally acceptable work; very weak performance with little evidence of original thinking, showing inadequate grasp of some basic elements of the course. Fx (under 60%): Inadequate work; poor performance that indicates a lack of understanding or misunderstanding of essential subject matter.

Learning outcomes:
The aim of the course is to show and explain to students the principles of mechanisms of basic types of organic reactions. After completing the subject, the students should be able to understand all organic reactions, which will enable them to creatively solve problems in organic synthesis, material chemistry, organic catalysis, bioorganic and medicinal chemistry.

Class syllabus:
1) Nucleophilic substitutions on sp3 carbons; 2) nucleophilic substitutions on sp2 carbons; 3) electrophilic and radical substitutions on sp3 carbons; 4) elimination reactions; 5) additions carbon-carbon multiple bonds; 6) seminar – solving mechanistic assignments; 7) electrophilic aromatic substitutions; 8) nucleophilic and radical aromatic substitutions; 9) nucleophilic additions C-heteroatom multiple bonds; 10) nucleophilic additions to activated carbon-carbon multiple bonds, chemistry of enolates; 11) nucleophilic and electrophilic molecular rearrangements, synthetically important cycloadditions; 12) seminar – solving mechanistic assignments

Recommended literature:
1. R. Brückner, M. Harmata, P. A. Wender, Organic mechanisms: reactions, stereochemistry and synthesis, Springer, 2010; 2. E. V. Anslyn, D. A. Dougherty, Modern physical organic chemistry, University Science, 2006; 3. J. Clayden, N. Greeves, S. Warren, P. Wothers, Organic Chemistry, Oxford University Press, 2000.

Languages necessary to complete the course:
English

Notes:
offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. Mgr. Radovan Šebesta, DrSc.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-172/25	Organic synthesis

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): The final grade consists of two parts – presentation of student's project (10%) and final written and oral exam (90%).
Grade scale: A 85%-100%, B 75%-85%, C 75%-70%, D 70%-65%, E 65%-60%, Fx 60% and less.

Learning outcomes:
Aims and Objectives:
Students will be able to propose multiple alternative strategies for synthesis of target molecules and evaluate the viability of the proposed paths from practical point of view. They will be able to apply theoretical principles of organic synthesis and reactivity trends to real problems. Students will be able to propose modern synthetic strategies using organo-main group reagents, protecting and activating groups.

Class syllabus:
Syllabus/Indicative Content:
Syllabus:
1.Retrosynthesis: basic terminology, synthons, oxidation states, donor/acceptor synthons, umpolung.
2.One-group disconnections of C-C bonds, disconnections of C-X bonds
3.Two-group disconnections, synthesis of 1,2; 1,3; 1,4; 1,5 and 1,6 difunctional compounds
4.Synthesis of cyclic compounds, Baldwin rules, synthesis of small, intermediate and large saturated rings, Diels-Alder and retro-Diels-Alder reaction, metathesis
5.Organo-main group chemistry I: organo- boron, aluminium and silicon compounds
6.Organo-main group chemistry II: organo- phosphorus and sulfur compounds
7.Organo-main group chemistry III: organo- halogen compounds
8.Organo-main group chemistry IV: organo- thalium, tin, lead, arsenic, antimony, bismuth, selenium, tellurium and mercury compounds
9.Protection, deprotection and activation of functional groups in synthesis
10. Synthesis of heterocyclic compounds I: saturated heterocycles and 5-membered aromatic heterocycles

11. Synthesis of heterocyclic compounds II: 6-membered aromatic heterocycles and condensed aromatic heterocycles
12. Synthesis of natural compounds and functional materials – strategy and tactics
13. Presentation of student projects – retrosynthesis and synthesis

Recommended literature:
Suggested readings:
Advanced organic chemistry, F. A. Carey, R. J. Sundberg, Springer, 2007
Organic synthesis - The disconnection approach, 2nd Edition, S. Warren, P. Wyatt, Wiley, 2008
Organic Synthesis - Strategy and Control, P. Wyatt, S. Warren, Wiley, 2007

Languages necessary to complete the course:
English

Notes:
offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Ing. Michal Májek, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-176/25	Organic synthesis

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
The final grade consists of two parts – presentation of student's project (10%) and final written and oral exam (90%).
Grade scale: A 85%-100%, B 75%-85%, C 75%-70%, D 70%-65%, E 65%-60%, Fx 60% and less.

Learning outcomes:
Students will be able to propose multiple alternative strategies for synthesis of target molecules and evaluate the viability of the proposed paths from practical point of view. They will be able to apply theoretical principles of organic synthesis and reactivity trends to real problems. Students will be able to propose modern synthetic strategies using organo-main group reagents, protecting and activating groups.

Class syllabus:
Syllabus:
1.Retrosynthesis: basic terminology, synthons, oxidation states, donor/acceptor synthons, umpolung.
2.One-group disconnections of C-C bonds, disconnections of C-X bonds
3.Two-group disconnections, synthesis of 1,2; 1,3; 1,4; 1,5 and 1,6 difunctional compounds
4.Synthesis of cyclic compounds, Baldwin rules, synthesis of small, intermediate and large saturated rings, Diels-Alder and retro-Diels-Alder reaction, metathesis
5.Organo-main group chemistry I: organo- boron, aluminium and silicon compounds
6.Organo-main group chemistry II: organo- phosphorus and sulfur compounds
7.Organo-main group chemistry III: organo- halogen compounds
8.Organo-main group chemistry IV: organo- thalium, tin, lead, arsenic, antimony, bismuth, selenium, tellurium and mercury compounds
9.Protection, deprotection and activation of functional groups in synthesis
10. Synthesis of heterocyclic compounds I: saturated heterocycles and 5-membered aromatic heterocycles
11. Synthesis of heterocyclic compounds II: 6-membered aromatic heterocycles and condensed aromatic heterocycles
12. Synthesis of natural compounds and functional materials – strategy and tactics

13. Presentation of student projects – retrosynthesis and synthesis

Recommended literature:
Advanced organic chemistry, F. A. Carey, R. J. Sundberg, Springer, 2007
Organic synthesis - The disconnection approach, 2nd Edition, S. Warren, P. Wyatt, Wiley, 2008
Organic Synthesis - Strategy and Control, P. Wyatt, S. Warren, Wiley, 2007

Languages necessary to complete the course:
English

Notes:
offered in winter semester only

Past grade distribution
Total number of evaluated students: 1

A	B	C	D	E	FX
0,0	100,0	0,0	0,0	0,0	0,0

Lecturers: Ing. Michal Májek, PhD.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-185/25	Organometallic chemistry

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:
The course evaluation is based on a written test comprising of writing products of a series or organometallic reactions on topics discussed during the course. The course has a standardized grading system which is identified below:
A (92 – 100%): Outstanding, excellent work (exceptional performance with strong evidence of original thinking and obvious capacity to analyze, synthesize and evaluate. B (84 – 91 %): Good, competent work; laudable performance with evidence of some original thinking, good problem-solving ability, exhibiting a serious, responsible engagement with the course content. C (76 – 83%): Adequate, reasonably satisfactory work; fair performance but infrequent evidence of original thinking or the capacity to analyze, satisfies the minimum requirements of the course. D (68 – 75%): Less acceptable work; relatively weak performance with little evidence of original thinking or ability to analyze or synthesize course material. E (60 – 67%): Minimally acceptable work; very weak performance with little evidence of original thinking, showing an inadequate grasp of some basic elements of the course. Fx (under 60%): Inadequate work; poor performance that indicates a lack of understanding or misunderstanding of essential subject matter.

Learning outcomes:
The aim of the course is to show and explain to students the principles of reactivity of organic compounds with transition and non-transition metals as well as the properties of such compounds. After completing the subject, the students should be able to understand the reactions in which organometallic compounds occur. They will also know the properties and possibilities of using all essential groups of organometallic compounds and apply this knowledge to solve practical problems.

Class syllabus:
History and definition of organometallic chemistry; nature of bonds in organometallic compounds; basic types of chemical reactions of organometallic compounds; nomenclature of organometallic compounds. Properties, structure, preparation, and use of organometallic compounds of non-transition metals. Compounds of lithium and other alkali metals. Magnesium and zinc compounds. Brief information on organocadmium and organomercury compounds. Chemistry of boron, aluminum and indium compounds. Brief information on gallium and thallium compounds.

Chemistry of Silicon and Tin Compounds. Brief information on germanium, lead, arsenic, antimony and bismuth compounds. Properties, structure, preparation, and use of organometallic compounds of transition metals. Organometallic compounds of copper, gold and silver. Metallocenes and metallocene-carbonyl complexes. Chemistry of compounds of early transition metals, especially titanium and zirconium. Use of palladium, nickel, rhodium, ruthenium, platinum and iridium in organic synthesis. Properties, structure and preparation of carbene complexes; metathesis of alkenes, alkynes and their combinations; organometallic compounds of f-metals.

Recommended literature:

1. C. Elschenbroich, Organometallics, Wiley-VCH, Weinheim, 2006;
2. R. Crabtree, The organometallic chemistry of the transition metals, Wiley, Hoboken, 2009;
3. J. F. Hartwig, Organotransition Metal Chemistry: From Bonding to Catalysis, University Science Books, 2010.

Languages necessary to complete the course:
English

Notes:
offered in winter semester only

Past grade distribution
Total number of evaluated students: 1

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. Mgr. Radovan Šebesta, DrSc.

Last change: 04.02.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJCh/N-XXXX-011/21	Perspectives in Chemistry

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 3.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 105

A	B	C	D	E	FX
45,71	27,62	7,62	2,86	0,95	15,24

Lecturers: doc. RNDr. Martin Putala, CSc., prof. RNDr. Ivan Černušák, DrSc., doc. RNDr. Erik Rakovský, PhD., Mgr. Peter Hrobárik, PhD., doc. RNDr. Oľga Rosskopfová, PhD., Mgr. Táňa Sebechlebská, PhD., Ing. Darina Tóthová, CSc., doc. RNDr. Radoslav Halko, PhD., prof. RNDr. Marian Masár, PhD., doc. RNDr. Jana Korduláková, PhD., doc. Mgr. Peter Polčic, PhD., doc. RNDr. Andrej Boháč, CSc.

Last change: 07.11.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KBCh/N-XXXX-010/22	Perspectives of Biochemistry

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 4.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 415

A	B	C	D	E	FX
92,53	0,0	0,0	0,0	0,0	7,47

Lecturers: doc. RNDr. Marek Mentel, PhD., prof. RNDr. Katarína Mikušová, DrSc., prof. RNDr. Anton Horváth, CSc., Mgr. Stanislav Huszár, PhD., doc. RNDr. Jana Korduláková, PhD., Ing. Martina Neboháčová, PhD., doc. Mgr. Peter Polčic, PhD., Mgr. Viktória Hodorová, PhD., RNDr. Ingrid Sveráková, PhD., doc. RNDr. Igor Zeman, PhD.

Last change: 19.09.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KTV/N-mXTV-110/22	Physical Education 10

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 260

A	B	C	D	E	FX
98,46	0,38	0,38	0,0	0,0	0,77

Lecturers: Mgr. Kristína Vanýsková, Mgr. Miriam Kirchmayerová, PhD., Mgr. Martin Mokošák, PhD., Mgr. Igor Remák, PhD., PaedDr. Mgr. Lenka Vandáková, Mgr. Denisa Strečanská, Mgr. PaedDr. Simona Rášiová, Mgr. Genc Berisha, PhD.

Last change: 01.08.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KTV/N-mXTV-107/22	Physical Education 7

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 528

A	B	C	D	E	FX
96,97	0,57	0,38	0,38	0,19	1,52

Lecturers: Mgr. Kristína Vanýsková, Mgr. Miriam Kirchmayerová, PhD., Mgr. Martin Mokošák, PhD., Mgr. Igor Remák, PhD., PaedDr. Mgr. Lenka Vandáková, Mgr. Denisa Strečanská, Mgr. Genc Berisha, PhD., Mgr. PaedDr. Simona Rášiová

Last change: 01.08.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KTV/N-mXTV-108/22	Physical Education 8

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 405

A	B	C	D	E	FX
96,79	0,25	0,0	0,0	0,0	2,96

Lecturers: Mgr. Kristína Vanýsková, Mgr. Miriam Kirchmayerová, PhD., Mgr. Martin Mokošák, PhD., Mgr. Igor Remák, PhD., PaedDr. Mgr. Lenka Vandáková, Mgr. Denisa Strečanská, Mgr. PaedDr. Simona Rášiová, Mgr. Genc Berisha, PhD.

Last change: 01.08.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KTV/N-mXTV-109/22	Physical Education 9

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 490

A	B	C	D	E	FX
97,55	0,2	0,41	0,0	0,0	1,84

Lecturers: Mgr. Kristína Vanýsková, Mgr. Miriam Kirchmayerová, PhD., Mgr. Martin Mokošák, PhD., Mgr. Igor Remák, PhD., PaedDr. Mgr. Lenka Vandáková, Mgr. Denisa Strečanská, Mgr. PaedDr. Simona Rášiová, Mgr. Genc Berisha, PhD.

Last change: 01.08.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-173/25	Physical organic chemistry

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 3 / 1 **per level/semester:** 39 / 13
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
active participation in seminars and successful completion of the exam. The exam consists of several examples with justification of their solution using theory. Each example is rated A-FX. The exam result is the average of their evaluation. Credits will not be awarded to a student who receives FX rating from any example. More than 50% of points must be obtained from each part of the grading. To obtain a total A rating it is necessary to obtain on average at least 90% of points, to obtain a B rating at least 80% points, to a C rating at least 70% points, to a D rating at least 60% points and to an E rating at least 50% points. Credits will not be awarded to a student who scores less than 50% of the points.

Learning outcomes:
The course creates a broad basis for a deeper study of the mechanisms of individual types of reactions. The student will gain a deeper insight into the structure of organic compounds and the most common intermediates and relation between structure and reactivity, including the quantification of this relation. Furthermore, he will become familiar with the methods of studying the mechanism of organic reactions and the influence of other factors (catalysis, solvation and others) on the course of reactions. Get a detailed inside of the reaction course of pericyclic and photochemical reactions.

Class syllabus:
Syllabus/Indicative Content:
1) Chemical bonds: bond types, bond and antibond orbitals (energy, geometry, symmetry, atomic orbital coefficients), bond parameters, π- and σ-conjugation, resonance structures.
2) Aromaticity: in the ground and transition states, aromaticity measures, aromaticity / antiaromaticity of annulenes and their derivatives, Hückel's rule, Möbius aromaticity, fused aromatic hydrocarbons.
3) Selected chapters from the stereochemistry of organic compounds. Chiral compounds without a stereogenic center. Dynamic stereochemistry of organic compounds: conformers of acyclic and cyclic compounds, Newman projection, conformational analysis, stereoisomerization (stereomutation). Different types of strain of cyclic compounds. Thorpe-Ingold effect, Baldwin's rules for closing cycles.

4) Kinetic and thermodynamic assumptions of the course of chemical reactions, free energy, enthalpy and entropy, activation enthalpy and entropy, internal vs. intermolecular reactions
5) Reaction mechanism: principle of microscopic reversibility, Hammond's postulate, Curtin-Hammett principle. Methods of studying the reaction mechanism, evidence and identification of intermediates, kinetic methods of studying the mechanism, including the kinetic isotope effect. Kinetic and thermodynamic controlled reactions.
6) Acids and bases. Brønsted's theory: influence of structural parameters on acidity, or basicity, Hammett's acidity function, kinetic and thermodynamic acidity. Lewis theory, Pearson's principle of hard and soft acids and bases and its applications.
7) Tautomerism: cationotropy (prototropy, metallotropy, acylotropy and others), anionotropy, valence tautomerism. Annular tautomerism and chain-ring tautomerism.
8) Hydrogen bonding and other weak interactions. Electrostatic interactions, interactions of dipoles with ions and dipoles. Hydrogen bonding and other types of interaction with the σ-hole. Methods of proof of hydrogen bonding, effect on physical properties and reactivity of compounds. Interactions of π-systems with each other, with dipoles and ions. Van der Waals forces, solvophobic effect, mechanical bond.
9) Catalysis of organic reactions: various types of acid-base catalysis, catalysis by transition metals and their complexes, nucleophilic catalysis, organocatalysis, micellar catalysis, catalysis by transfer to another phase, enzyme catalysis.
10) Solvation: characterization of solvation properties of solvents, influence of solvation on chemical equilibrium and speed of various types of reactions. Solubility, diffusion, alternative solvents, computer modeling of solvation.
11) Free energy relationships: quantification of the effect of electronic and steric properties of substituents on the rate and equilibrium of chemical reactions. Hammett equation and its modifications, isokinetic principle, two-parameter equations of the Swain-Lupton equation type, Taft equations. Applying these equations.
12) Reaction intermediates: generation, structure and reactivity of carbocations, carbanions, radicals, carbenes, nitrenes and ylides, dehydroarenes and complexes with charge transfer, dehydroarenes. The effect of the structure on their stability - stabilization by various effects.
13) Pericyclic reactions: Woodward-Hoffmann rules (Fukui's modification) of conservation of MO symmetry, Dewar-Zimmerman method of transition state aromaticity and their application to individual types of reactions. Electrocyclization reactions, sigmatropic rearrangements, cycloaddition reactions, group transfer reactions.
14) Photochemistry: absorption of light, physical and chemical processes from the excited state; Jablonski diagram, influence of various factors on the course of photochemical reactions, quantum yield, photostationary state, photocatalysis.

Recommended literature:

Suggested readings:

1) E. V. Anslyn, D. A. Dougherty: Modern Physical Organic Chemistry, University Science Book, California 2006.
2) I. Fleming: Molecular Orbitals and Organic Chemical Reactions, Student ed., John Wiley & Sons, 2009.
3) J. Clayden, N. Greeves, S. Warren: Organic Chemistry, 2nd ed., Oxford University Press, 2012.
4) F. A. Carey, R. J. Sundberg: Advanced Organic Chemistry, Part A: Structure and Mechanisms, 5th ed., Springer, 2007.
5) March’s Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, 7th ed., M. B. Smith, John Wiley & Sons, 2013.

6) E. L. Eliel, S. H. Wilen, M. P. Doyle: Basic Organic Stereochemistry, John Wiley & Sons, 2001.

Languages necessary to complete the course:
English

Notes:
offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Martin Putala, CSc.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.KAgCh/N-CHEM-959/25	**Course title:** Physical-chemical methods in inorganic chemistry
Number of credits: 2	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: doc. RNDr. Martin Putala, CSc.	

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Natural Sciences	
Course ID: PriF.KOrCh/N-CHEM-953/25	**Course title:** Physical-chemical methods in organic chemistry
Number of credits: 2	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: doc. RNDr. Martin Putala, CSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KBo/N-XXXX-003/21	Plants known and unknown

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1., 3.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 1434

A	B	C	D	E	FX
68,83	19,46	6,07	0,0	1,39	4,25

Lecturers: Ing. Mgr. Eva Zahradníková, PhD., doc. Mgr. Katarína Mišíková, PhD., doc. RNDr. Jana Ščevková, PhD.

Last change: 30.08.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.LPM/N-mLPM-003/25	Polymer chemistry and polymeric biomaterials

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers:

Last change:

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KRGRR/N-XXXX-002/21	Practical Geography for Natural Scientists

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 1 **per level/semester:** 13 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1., 3.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 122

A	B	C	D	E	FX
89,34	0,0	0,82	0,0	0,82	9,02

Lecturers: Mgr. Rastislav Cákoci, PhD., RNDr. Katarína Danielová, PhD., doc. RNDr. Daniel Gurňák, PhD., doc. RNDr. František Križan, PhD., doc. RNDr. Eva Rajčáková, CSc., Mgr. Michala Sládeková Madajová, PhD., RNDr. Angelika Švecová, PhD., doc. Mgr. Martin Šveda, PhD., prof. RNDr. Ladislav Tolmáči, PhD., RNDr. Mgr. Anna Tolmáči, PhD., Mgr. Gabriel Zubriczký, PhD.

Last change: 15.05.2021

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KIHG/N-XXXX-012/21	Practical Geology for Everyone

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1., 3.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 548

A	B	C	D	E	FX
76,64	10,95	4,2	1,46	0,55	6,2

Lecturers: doc. RNDr. Renáta Fľaková, PhD., doc. RNDr. Renáta Adamcová, PhD., prof. RNDr. Roman Pašteka, PhD., prof. RNDr. Martin Bednarik, PhD., doc. RNDr. Dávid Krčmář, PhD., doc. RNDr. Andrej Mojzeš, PhD., RNDr. Ivana Ondrejková, PhD., doc. Mgr. Vladimír Greif, PhD., Mgr. Rudolf Tornyai, PhD., RNDr. Tatiana Durmeková, PhD., Mgr. Martin Zatlakovič, PhD., doc. RNDr. Milan Seman, CSc.

Last change: 18.09.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCXX-007/25	Professional internship

Educational activities:
Type of activities: practice
Number of hours:
per week: **per level/semester:** 3t
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
The quality of the student's independent work is evaluated - conducting laboratory experiments and the quality of the results achieved, keeping a laboratory diary, preparing interim reports, analyzing and presenting the results. Grades will be based on the final practical training report (contributing 100%), which has a standardized grading system identified below:
A (91 – 100%): Outstanding, excellent work (exceptional performance with strong evidence of original thinking and obvious capacity to analyze, synthesize and evaluate. B (81 – 90 %): Good, competent work; laudable performance with evidence of some original thinking, good problem-solving ability, exhibiting a serious, responsible engagement with the course content. C (73 – 80%): Adequate, reasonably satisfactory work; fair performance but infrequent evidence of original thinking or the capacity to analyze, satisfies the minimum requirements of the course. D (66 – 72%): Less acceptable work; relatively weak performance with little evidence of original thinking or ability to analyze or synthesize course material. E (60 – 65%): Minimally acceptable work; very weak performance with little evidence of original thinking, showing inadequate grasp of some basic elements of the course. Fx (under 60%): Inadequate work; poor performance that indicates a lack of understanding or misunderstanding of essential subject matter.

Learning outcomes:
During practice, students will improve their skill in laboratory techniques and expand their theoretical knowledge in the study area and enables close collaboration with professional research groups.

Class syllabus:
Systematic work in the laboratory, applications of special laboratory techniques and methods related to the diploma thesis.

Recommended literature:
Specifically, as recommended by supervisor

Languages necessary to complete the course:
English

Notes:

The course can be completed only after the exams in the summer semester.

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers:

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KFTCh/N-mCFZ-192/25	Programming in Python

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 1 **per level/semester:** 13 / 13
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 4.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): The course evaluation is based on a written test and a simple programming assignment based on topics lectured during the course. The course has a standardized grading system which is identified below:
A (92 – 100%): Outstanding, excellent work (exceptional performance with strong evidence of original thinking and obvious capacity to analyze, synthesize and evaluate. B (84 – 91 %): Good, competent work; laudable performance with evidence of some original thinking, good problem-solving ability, exhibiting a serious, responsible engagement with the course content. C (76 – 83%): Adequate, reasonably satisfactory work; fair performance but infrequent evidence of original thinking or the capacity to analyze, satisfies the minimum requirements of the course. D (68 – 75%): Less acceptable work; relatively weak performance with little evidence of original thinking or ability to analyze or synthesize course material. E (60 – 67%): Minimally acceptable work; very weak performance with little evidence of original thinking, showing an inadequate grasp of some basic elements of the course. Fx (under 60%): Inadequate work; poor performance that indicates a lack of understanding or misunderstanding of essential subject matter.

Learning outcomes:
Aims and Objectives:
Students attending the course will get familiar with basics of programming and algorithmic thinking using the Python programming language. The course content is focused on data processing and visualization, as these are application areas most beneficiary for students of natural sciences. This course is designed for beginners with no prior programming experience. By the end of this course, students will gain essential programming skills to write their own Python programs addressing basic scientific data-driven tasks.

Class syllabus:
Syllabus/Indicative Content:
Introduction to computer architecture and algorithmization
Introduction to Python: basic Python syntax, variables, operations, loops, conditionals and functions
Data structures in Python: lists, sets, tuples.
Introduction to numpy and pandas

Data manipulation and analysis: filtering, merging, data cleaning
Introduction to matplotlib: data visualization - scatter plots, histograms, heatmaps

Recommended literature:
Suggested readings:
Jake VanderPlas: Python Data Science Handbook: Essential Tools for Working with Data. O'Reilly Media, 2016.

Languages necessary to complete the course:
English

Notes:
Students are required to bring their own device (ideally notebook, without any limitations on operating system).

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Dávid Vrška, PhD., doc. Mgr. Michal Pitoňák, PhD., doc. Mgr. Pavel Neogrády, DrSc.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJCh/N-mCJD-193/25	Radiochemistry (1)

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The applicant successful graduation of the course is to obtain minimally 60 % of points of the final examination: seminar work (50%) + examination (50%). For the grade A (excellent) it is necessary to obtain at least 92–100%, to obtain the grade B (very good) at least 84–91%, for the grade C (good) at least 76–83%, for the grade D (satisfactory) at least 68– 75% and for E rating (adequate) at least 60–67%. A rating below 60% is rated as FX (insufficient).

Learning outcomes:
Aims and Objectives:
Radiochemistry is the study of radiation from an atomic and molecular perspective, including elemental transformation and reaction effects, as well as physical, health and medical properties. Based on these students how to use radioactivity as a tool for chemically related research and related fields (for example material science, biochemistry, and medicine). The course teaches students fundamental radiochemical methods for qualitative and quantitative analysis of radionuclides in various media. The principles for the detection of radioactive radiation and material will be thoroughly covered.

Class syllabus:
Syllabus/Indicative Content:
Radiochemistry fundamentals. Radiochemistry for the environment. Radiochemistry for health. Radiochemistry for industry. Radiochemistry for nuclear energy. Radiochemistry for society.

Recommended literature:
Suggested readings:
•Walter D. Loveland, David J. Morrissey, Glenn T. Seaborg (2006). Modern Nuclear Chemistry. John Wiley & Sons, Inc. ISBN:9780471115328. •József Kónya, Noémi M. Nagy (2012). Nuclear and Radiochemistry. ELSEVIER. ISBN 978-0-12-391430-9. DOI https://doi.org/10.1016/C2011-0-06943-0 •Gregory Choppin (2013) Radiochemistry and Nuclear Chemistry. Elsevier Books. EAN: 9780124058972. •POK - Essential radiochemistry for society •Negrin M., Macerata

E., Concia F. et al (2023): A MOOC in Nuclear- and Radio-Chemistry: from the design to the feedback. J. Radioanal. Nucl. Chem. https://doi.org/10.1007/s10967-022-08489-6

Languages necessary to complete the course:
English

Notes:
offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Ing. Helena Švajdlenková, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJCh/N-mCJD-194/25	Radiochemistry (2)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 5 **per level/semester:** 65
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 2., 4.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The applicant successful graduation of the course is to obtain minimally 60 % of points of the final assessment: continuous assessment (60%) + examination (40%). For the grade A (excellent) it is necessary to obtain at least 92–100%, to obtain the grade B (very good) at least 84–91%, for the grade C (good) at least 76–83%, for the grade D (satisfactory) at least 68– 75% and for E rating (adequate) at least 60–67%. A rating below 60% is rated as FX (insufficient).

Learning outcomes:
Aims and Objectives:
Students will understand the properties of atomic nuclei, the laws of radioactive decay, nuclear reactions, and the principles of radiation interaction with the environment and its detection. They will acquire basic knowledge of the practical application of radionuclides and ionizing radiation. Students will gain fundamental experimental skills necessary for working with radioactive substances, both sealed and open sources. They will become familiar with nuclear radiation detection and will be able to measure and determine radionuclide activity using basic methods in radiochemistry.

Class syllabus:
Syllabus/Indicative Content:
1. Safety regulations in radioisotope laboratories, radiation hygiene, and institutional radioactive waste management. 2. Basic calculations and statistics in nuclear chemistry. 3. – 4. Detection and measurement of ionizing radiation. 5. Spectrometry of ionizing radiation. 6. Dosimetry of ionizing radiation. 7. Nuclear methods: Neutron activation analysis. 8. Nuclear methods: Radioindicator methods, isotopes in biochemistry, LSC. 9. Radionuclides in radiopharmacy and nuclear medicine, determination, and comparison of chemical forms of Tc. 10. Separation of radioactive substances, determination of mass activity of Sr-90. 11. Radiochemical analysis, STN 17025, determination of tritium in water. 12. Nuclear fuel – U, Pu, Th. Radionuclides originating from nuclear energy – Cs, Sr, Co, Ni. 13. Radioactive contamination, measurement of surface contamination, decontamination.

Recommended literature:

Suggested readings:
•Walter D. Loveland, David J. Morrissey, Glenn T. Seaborg (2006). Modern Nuclear Chemistry. John Wiley & Sons, Inc. ISBN:9780471115328. •József Kónya, Noémi M. Nagy (2012). Nuclear and Radiochemistry. ELSEVIER. ISBN 978-0-12-391430-9. DOI https://doi.org/10.1016/C2011-0-06943-0 •Gregory Choppin (2013) Radiochemistry and Nuclear Chemistry. Elsevier Books. EAN: 9780124058972. •POK - Essential radiochemistry for society •Negrin M., Macerata E., Concia F. et al (2023): A MOOC in Nuclear- and Radio-Chemistry: from the design to the feedback. J. Radioanal. Nucl. Chem. https://doi.org/10.1007/s10967-022-08489-6 •Galanda, D. - Slimáková, J. - Dulanská, S.: Cvičenie z jadrovej chémie. Univerzita Komenského v Bratislave. 2019. 100 s. 978-80-223-4836-2.

Languages necessary to complete the course:

English

Notes:

offered in summer semester only

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: RNDr. Dominik Juračka

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCXX-002/25	Research laboratory (1)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 3 **per level/semester:** 39
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
The quality of the student's independent work is evaluated - conducting laboratory experiments and the quality of the results achieved, keeping a laboratory diary, preparing interim reports, analyzing and presenting the results. Grades will be based on the final practical training report (contributing 100%), which has a standardized grading system identified below:
A (91 – 100%): Outstanding, excellent work (exceptional performance with strong evidence of original thinking and obvious capacity to analyze, synthesize and evaluate. B (81 – 90 %): Good, competent work; laudable performance with evidence of some original thinking, good problem-solving ability, exhibiting a serious, responsible engagement with the course content. C (73 – 80%): Adequate, reasonably satisfactory work; fair performance but infrequent evidence of original thinking or the capacity to analyze, satisfies the minimum requirements of the course. D (66 – 72%): Less acceptable work; relatively weak performance with little evidence of original thinking or ability to analyze or synthesize course material. E (60 – 65%): Minimally acceptable work; very weak performance with little evidence of original thinking, showing inadequate grasp of some basic elements of the course. Fx (under 60%): Inadequate work; poor performance that indicates a lack of understanding or misunderstanding of essential subject matter.

Learning outcomes:
The student conducts research on a given topic and learns to obtain his own experimental data, which he subsequently interprets under the professional supervision of the teacher.

Class syllabus:
Working with literary sources and carrying out experiments under the expert guidance of pedagogical and scientific staff on a specifically assigned topic. Theoretical and practical preparation for the diploma thesis.

Recommended literature:
Specifically, as recommended by supervisor

Languages necessary to complete the course:
English

Notes:

offered in winter semester only

Past grade distribution
Total number of evaluated students: 1

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: RNDr. Milan Sýkora, PhD., MBA

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCXX-003/25	Research laboratory (2)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 3 **per level/semester:** 39
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
The quality of the student's independent work is evaluated - conducting laboratory experiments and the quality of the results achieved, keeping a laboratory diary, preparing interim reports, analyzing and presenting the results. Grades will be based on the final practical training report (contributing 100%), which has a standardized grading system identified below:
A (91 – 100%): Outstanding, excellent work (exceptional performance with strong evidence of original thinking and obvious capacity to analyze, synthesize and evaluate. B (81 – 90 %): Good, competent work; laudable performance with evidence of some original thinking, good problem-solving ability, exhibiting a serious, responsible engagement with the course content. C (73 – 80%): Adequate, reasonably satisfactory work; fair performance but infrequent evidence of original thinking or the capacity to analyze, satisfies the minimum requirements of the course. D (66 – 72%): Less acceptable work; relatively weak performance with little evidence of original thinking or ability to analyze or synthesize course material. E (60 – 65%): Minimally acceptable work; very weak performance with little evidence of original thinking, showing inadequate grasp of some basic elements of the course. Fx (under 60%): Inadequate work; poor performance that indicates a lack of understanding or misunderstanding of essential subject matter.

Learning outcomes:
The student obtains his own experimental data, which he processes and interprets appropriately. He will also understand the process of optimizing individual experiments. After successfully completing the subject, the student is able to creatively process information from scientific sources on the given topic and work independently in the laboratory.

Class syllabus:
Involvement of the student in the scientific work that precedes the diploma thesis, the implementation and evaluation of experiments under the professional guidance of pedagogical and scientific staff on a specifically assigned topic.

Recommended literature:
Specifically, as recommended by supervisor

Languages necessary to complete the course:

English

Notes:
offered in summer semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers:

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KTV/N-mXTV-112/22	River rafting

Educational activities:
Type of activities: other
Number of hours:
per week: **per level/semester:** 3d
Form of the course: on-site learning

Number of credits: 1

Recommended semester: 2., 4.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 58

A	B	C	D	E	FX
82,76	0,0	0,0	0,0	0,0	17,24

Lecturers: Mgr. Miriam Kirchmayerová, PhD., Mgr. Martin Mokošák, PhD., Mgr. Igor Remák, PhD., PaedDr. Mgr. Lenka Vandáková, Mgr. Kristína Vanýsková, Mgr. Denisa Strečanská, Mgr. PaedDr. Simona Rášiová, Mgr. Genc Berisha, PhD.

Last change: 01.08.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJ/N-mXCJ-090/24	Slovak for Foreign Students

Educational activities:
Type of activities: seminar
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 2.., 3., 4..

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 9

A	B	C	D	E	FX
88,89	0,0	11,11	0,0	0,0	0,0

Lecturers: Mgr. Karin Rózsová Wolfová

Last change: 05.09.2024

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.LPM/N-mLPM-007/25	Solid state chemistry and advanced materials

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2.

Educational level: II.

Prerequisites:

Recommended prerequisites:
course offered in winter semester only

Course requirements:
Grading: The grading is based on a written test including examples taken during the course period. The overall grading : A: 92-100%, B: 84-91%, C: 76-83%, D: 68-75%, E: 60-67

Learning outcomes:
Objectives of the course:
Students will gain deeper understanding solid state chemistry and preparation, properties and applications of selected groups of modern advanced materials.

Class syllabus:
Abbreviated syllabus:
Solid-state chemistry: principles, high-temperature and low-temperature methods, understanding and use of phase diagrams, mechanisms of solid-state reactions. Perovskites: catergorization, structure, preparation, properties and applications, Porous materials: clays and zeolites, structure, preparation, properties and applications, Materials for batteries and energy storage. Inorganic Polymers and Metal-Organic-Frameworks (MOFs), preparation, structure properties and applications. Advanced ceramics, categorization, structure, preparation, properties and applications, conductive and bioceramics.

Recommended literature:
Abbreviated syllabus:
Solid-state chemistry: principles, high-temperature and low-temperature methods, understanding and use of phase diagrams, mechanisms of solid-state reactions. Perovskites: catergorization, structure, preparation, properties and applications, Porous materials: clays and zeolites, structure, preparation, properties and applications, Materials for batteries and energy storage. Inorganic Polymers and Metal-Organic-Frameworks (MOFs), preparation, structure properties and applications. Advanced ceramics, categorization, structure, preparation, properties and applications, conductive and bioceramics.

Languages necessary to complete the course:

#The course is taught in English. Recommended literature is in English

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Roman Bystrický, PhD.

Last change: 16.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAgCh/N-mCAG-166/25	Structure of solids

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 1

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Erik Rakovský, PhD.

Last change: 15.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KTV/N-mUXX-210/25	Summer Physical-Education Training

Educational activities:
Type of activities: training session
Number of hours:
per week: **per level/semester:** 6d
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 4.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Miriam Kirchmayerová, PhD., Mgr. Martin Mokošák, PhD., Mgr. Peter Nehila, Mgr. PaedDr. Simona Rášiová, Mgr. Igor Remák, PhD., Mgr. Denisa Strečanská, PaedDr. Mgr. Lenka Vandáková, Mgr. Kristína Vanýsková

Last change:

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-126/22	Supramolecular Chemistry

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 9

A	B	C	D	E	FX
55,56	11,11	33,33	0,0	0,0	0,0

Lecturers: doc. RNDr. Martin Putala, CSc.

Last change: 13.09.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KFTCh/N-mCFZ-191/25	Surface chemistry

Educational activities:
Type of activities: practicals / lecture
Number of hours:
per week: 1 / 1 **per level/semester:** 13 / 13
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
The grading is based on an oral examination (25% of the grade) and a written test including examples (75% of the grade) taken during the examination period. The overall grading : A: 92-100%, B: 84-91%, C: 76-83%, D: 68-75%, E: 60-67

Learning outcomes:
The student will acquire the deeper understanding of the field of surface chemistry and surface science. This course provides an overview of processes on solid surfaces, ranging from basic principles such as adsorption, surface symmetry and the Langmuir model, to vacuum techniques, microscopy and surface spectroscopy, to examples in heterogeneous catalysis and formation of surface structures.

Class syllabus:
Emergence of surface science, principles, applications and new directions. Solids, crystal bonding, dipole, Lennard-Jones potential, cohesive energies. Symmetry of surface atoms, Miller indices, surface coverage by adsorbates and their symmetry. Real and reciprocal space, wave vector. Adsorption, heat of adsorption, coverage function and steps/terraces. Placement coefficient and attachment probability. Physisorption and chemisorption, molecular and dissociative adsorption. Chemical surface reaction, Langmuir-Hinshelwood and Eley-Rideal models. Surface diffusion and desorption. Kinetics of adsorption, Langmuir model and BET isotherm. Phonon, plasmon, exciton and polaron. Particle flow, collisions, mean free path, vacuum technique and technology. Pumps - rotational, diffusion, ionic and molecular. Vacuum chamber, flanges, manipulator, valve and vacuum measuring unit. Thermal electron emission and current density. Fermi level, vacuum level and output work. Analyzer - ionization, separation and detection. Conversion dyno and electron multiplier. Scanning tunneling microscopy (STM), atomic force microscopy (AFM) and low energy electron diffraction (ED). X-ray photoelectron spectroscopy (PES) and secondary ion mass spectrometry (SIMS). Electron energy loss spectroscopy (EELS) and infrared reflection-adsorption spectroscopy (DRIFTS). Temperature-controlled desorption and the Redhead equation. Heterogeneous catalysis and activation energy. Automotive exhaust gas catalyst, lambda sensor and three-way mechanism. Air-fuel ratio, efficiency for CO, NOx and HC conversion. Catalytic synthesis of NH3, Fe catalyst and its surface structure. Surface heterostructures and semiconductor

components. Example of laser diode, structures and thresholds. Quantum refined structures - quantum film, wire and point. Self-ordered monolayers. Nanotechnology. Preparation techniques – chemical vapor deposition (CVD), co-deposition with organometallic molecules, atomic layer deposition (ALD), molecular beam epitaxy (MBE), laser ablation/deposition (LAD). Mechanisms of thin film growth - Volmer-Weber, Stranski-Krastanov and Franck-VanderMerwe.

Recommended literature:
G. Ertl: Reactions at Solid Surfaces, Wiley, New York, 2009

Languages necessary to complete the course:
#The course is taught in English. Recommended literature is in English.

Notes:
#course offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: RNDr. Monika Stupavská, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KZ/N-XXXX-006/21	Theory of species

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 4.

Educational level: I., II., P

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 261

A	B	C	D	E	FX
51,34	21,07	11,11	2,3	0,77	13,41

Lecturers: doc. Mgr. Peter Vďačný, PhD.

Last change: 07.11.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-157/25	Trends in Analytical Chemistry

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation): The evaluation of the subject includes the verification of knowledge from the lectures in the form of a final written test, for a maximum of 100 points. A total of at least 92 points is required to obtain an A grade, at least 84 points to obtain a B grade, at least 76 points for a C grade, at least 68 points for a D grade, and at least 60 points for an E grade. The evaluation is identical even for the distance form of education.

Learning outcomes:
Aims and Objectives:
The student will become familiar with new trends in the development of analytical methods from single-component macroanalysis to multicomponent trace microanalysis. The student will understand the technical and methodological limitations of current analytical methods and the trends in their development, which will be assisted by invited lecturers from real analytical practice, e.g. from clinical and environmental laboratories and chemical companies. After completing the subject, the student is able to solve analytical problems of real environmental, biological, food and technological samples.

Class syllabus:
Syllabus/Indicative Content:
• Trends in Bioanalytical Chemistry. Trends in Green Analytical Chemistry.
• Miniaturized analytical systems. Trends in electroseparation methods.
• Trends in chromatographic methods.
• Complementarity of electrophoretic and chromatographic separations.
• Trends in electrochemical analysis.
• Trends in atomic spectrometry. Trends in mass spectrometry.
• Trends in pharmaceutical analysis.
• Advanced methods of solid phase analysis and their application in pharmaceutical analysis.

Recommended literature:
Suggested readings:

Current monographic and magazine literature and Internet information resources. Original and review articles from professional magazines.

Languages necessary to complete the course:
English

Notes:
course offered in winter semester only

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Marian Masár, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJ/N-mXCJ-084/22	UNIcert Deutsch 1

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 4

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Karin Rózsová Wolfová

Last change: 24.07.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJ/N-mXCJ-085/22	UNIcert Deutsch 2

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 2

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Karin Rózsová Wolfová

Last change: 24.07.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJ/N-mXCJ-082/22	UNIcert English 1

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 155

A	B	C	D	E	FX
92,26	2,58	1,29	1,94	0,0	1,94

Lecturers: PhDr. Štefánia Dugovičová, PhD., Mgr. Lenka Jeleňová, Mgr. Barbara Kordíková, PhD., PaedDr. Stanislav Kováč, PhD., RNDr. Tatiana Slováková, PhD.

Last change: 26.09.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KJ/N-mXCJ-083/22	UNIcert English 2

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 113

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: PhDr. Štefánia Dugovičová, PhD., Mgr. Lenka Jeleňová, Mgr. Barbara Kordíková, PhD., PaedDr. Stanislav Kováč, PhD., RNDr. Tatiana Slováková, PhD.

Last change: 26.09.2022

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KAlCh/N-mCAL-158/25	Validation of analytical and bioanalytical methods

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 1 / 1 **per level/semester:** 13 / 13
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Grading Policy (Assessment/Evaluation):
The evaluation of the subject includes the verification of knowledge from seminars and lectures, for a maximum of 100 points. The seminar (maximum number of 40 points) includes the development and presentation of a seminar paper. The lecture (maximum number of 60 points) includes a final written test. The final grade includes the assessment from the final written test and the seminar. A total of at least 92 points is required to obtain an A grade, at least 84 points to obtain a B grade, at least 76 points for a C grade, at least 68 points for a D grade, and at least 60 points for an E grade. The evaluation is identical even for the distance form of education.

Learning outcomes:
Aims and Objectives:
The student obtains theoretical and practical understanding of the principles of validation of analytical methods as well as familiarity with contemporary guidelines for the validation of analytical and bioanalytical methods. Upon completion of the course the student will understand the philosophy behind the validation, understand the logic behind setting up validation criteria, will be able to draft validation protocols and carry out calculations essential in the assessment of validation data.

Class syllabus:
Syllabus/Indicative Content:
• Introduction to validation of manufacturing processes, analytical procedures and relevant legislation covering validation.
• Overview of quality, safety, efficacy, and multidisciplinary guidelines published by ICH.org.
• Introduction to ICH guidelines for validation of analytical and bioanalytical methods and highlighting of key differences.
• Introduction to product specification setting.
• Construction of validation protocols for different types of analytical test
• Method development lifecycle, analytical method lifecycle, Analytical quality by design and principles of setting up the Analytical Target Profile

• Classification of analytical tests based on the purpose of the analysis and development of understanding of which validation characteristics are relevant for which type of analytical testing.
• Essential validation characteristics, understanding of their purpose and experimental techniques used for data gathering: Accuracy, Precision, Specificity, Limit of Detection, Limit of Quantitation, Linearity, Robustness, and the Range
• Essential calculations for assessment of validation data.
• Examples of pass/fail criteria for different types of analytical tests.
• Conclusion and reporting of validation experiment, setting up system suitability criteria

Recommended literature:

Suggested readings:
1. Validation of analytical procedures: text and methodology Q2(R1).
(2005) Proceedings of the International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use, Geneva
ICH ICH Harmonised Tripartite Guideline Accessed 29 January 2024
https://database.ich.org/sites/default/files/Q2%28R1%29%20Guideline.pdf
2. Bioanalytical method validation and study
sample analysis: text and methodology M10
(2005) Proceedings of the International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use, Geneva
ICH ICH Harmonised Tripartite Guideline Accessed 29 January 2024
https://database.ich.org/sites/default/files/M10_Guideline_Step4_2022_0524.pdf

Languages necessary to complete the course:

English

Notes:

course offered in winter semester only

Past grade distribution

Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. Ing. Roman Szücs, PhD., doc. RNDr. Andrea Vojs Staňová, PhD., prof. PharmDr. Josef Jampílek, PhD.

Last change: 20.01.2026

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KTV/N-mUXX-209/25	Winter Physical-Education Training

Educational activities:
Type of activities: training session
Number of hours:
per week: **per level/semester:** 6d
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 31

A	B	C	D	E	FX
80,65	0,0	0,0	0,0	0,0	19,35

Lecturers: Mgr. Miriam Kirchmayerová, PhD., Mgr. Martin Mokošák, PhD., Mgr. PaedDr. Simona Rášiová, Mgr. Igor Remák, PhD., Mgr. Denisa Strečanská, PaedDr. Mgr. Lenka Vandáková, Mgr. Kristína Vanýsková

Last change:

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KOrCh/N-mCOR-187/25	Winter research laboratory

Educational activities:
Type of activities: practice
Number of hours:
per week: **per level/semester:** 3t
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 0

A	B	C	D	E	FX
0,0	0,0	0,0	0,0	0,0	0,0

Lecturers:

Last change:

Approved by: doc. RNDr. Martin Putala, CSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Natural Sciences

Course ID:	**Course title:**
PriF.KTV/N-mXTV-111/22	Ďumbier mountain hiking

Educational activities:
Type of activities: other
Number of hours:
per week: **per level/semester:** 3d
Form of the course: on-site learning

Number of credits: 1

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 138

A	B	C	D	E	FX
84,06	0,0	0,0	0,0	0,0	15,94

Lecturers: Mgr. Miriam Kirchmayerová, PhD., Mgr. Martin Mokošák, PhD., Mgr. Igor Remák, PhD., PaedDr. Mgr. Lenka Vandáková, Mgr. Kristína Vanýsková, Mgr. Denisa Strečanská, Mgr. PaedDr. Simona Rášiová, Mgr. Genc Berisha, PhD.

Last change: 01.08.2022

Approved by: doc. RNDr. Martin Putala, CSc.