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COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-123/24	Ab initio Modelling of Materials

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

Number of credits: 4

Recommended semester: 2.

Educational level: II.

Prerequisites:

Recommended prerequisites:
The course requires knowledge of standard classical MD/MC simulation methods on the level of the course FMFI.KEF/2-FTL-110/22 Computer simulations of condensed matter.

Course requirements:
At the end of the semester a simulation problem will be assigned and the student will provide a written report on the solution. The grade will be based on the evaluation of the report. Grade: A 90%, B 80%, C 70%, D 60%, E 50%.
Scale of assessment (preliminary/final): 0/100

Learning outcomes:
The course provides an introduction to current methods of materials modeling based on ab initio approaches. It focuses on static and dynamical simulations (ab initio molecular dynamics) based on the density functional theory (DFT) for electrons and their applications to various condensed matter systems. Quantum Monte Carlo methods for electrons (Diffusion Monte Carlo) and ions (Path Integral Monte Carlo) will be mentioned too. Besides that new approaches to force-field generation based on machine learning will be shown, as well as other possible applications of machine learning in materials simulations. The methods will be illustrated on a number of examples and in the exercises the student will learn to use the freely available ab initio code Quantum Espresso.

Class syllabus:
materials modeling, structural prediction, calculation of properties density functional theory (DFT), Hohenberg - Kohn theorems Kohn - Sham method and equations approximate DFT functionals - LDA, GGA, hybrid practical approach to solving Kohn-Sham equations - plane-wave basis expansion of wavefunctions, pseudopotentials ab initio molecular dynamics evolutionary algorithms and crystal structure prediction Diffusion Quantum Monte Carlo approach (DMC) Path Integral Monte Carlo methods machine-learning-based methods of generating force-fields further applications of machine learning in materials simulations

Recommended literature:
F. Giustino, Materials Modelling using Density Functional Theory, Oxford University Press 2014

D.S. Sholl, J.A. Steckel, Density functional theory (A practical introduction), John Wiley & sons, 2009
Wolfram Koch, Max C. Holthausen, A Chemist's Guide to Density Functional Theory, 2001 Wiley#VCH Verlag GmbH

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 6

A	B	C	D	E	FX
66,67	0,0	16,67	16,67	0,0	0,0

Lecturers: prof. Ing. Roman Martoňák, DrSc.

Last change: 26.08.2024

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-MXX-133/23	Artificial Intelligence for Everyone

Educational activities:
Type of activities: training session / course
Number of hours:
per week: 9 **per level/semester:** 1t / 117
Form of the course: on-site learning

Number of credits: 6

Recommended semester:

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: 22

A	B	C	D	E	FX
45,45	36,36	4,55	9,09	4,55	0,0

Lecturers: prof. Ing. Igor Farkaš, Dr.

Last change:

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KEF/2-FTL-110/22	**Course title:** Computer Simulations of Condensed Matter
Educational activities: **Type of activities:** lecture / practicals **Number of hours:** **per week:** 2 / 2 **per level/semester:** 26 / 26 **Form of the course:** on-site learning	
Number of credits: 5	
Recommended semester: 1.	
Educational level: II.	
Prerequisites:	
Recommended prerequisites: The course requires knowledge of statistical mechanics on the level of a standard bachelor course.	
Course requirements: At the end of the semester a simulation problem will be assigned and the student will provide a written report on the solution. The grade will be based on the evaluation of the report. Grade: A 90%, B 80%, C 70%, D 60%, E 50% Scale of assessment (preliminary/final): 0/100	
Learning outcomes: The course presents the basic principles of modern computer simulation methods and their application to an effective solution of a broad spectrum of problems in various branches of condensed matter physics. The student will also learn to analyze, visualize and interpret the simulation results. The course will focus on the molecular dynamics and Monte Carlo methods. An important ingredient of the course is also solving of complex optimization problems which are often encountered in science, technology and everyday life. During exercises the student will become familiar with the application of the presented methods to clusters, crystals and liquids, including phase transitions. The course covers also simulations of activated processes where the system crosses a free-energy barrier.	
Class syllabus: The role of computer simulations in physics - experiment, theory, simulations Ergodic theorem Molecular dynamics (MD) Description of interactions - force fields for various types of interatomic interactions Periodic boundary conditions, interaction cutoff, Ewald summation for Coulomb systems Constant temperature and pressure MD, MD for molecular systems Post-processing of simulation data - estimation of statistical error Calculation of time correlation functions - relation to physical quantities Monte Carlo methods - simple and importance sampling, detailed balance	

Metropolis algorithm for systems with discrete and continuous degrees of freedom
Optimization algorithms for complex problems - simulated annealing, evolutionary algorithms
Free-energy calculations, phase diagrams
Simulations of 1st and 2nd order phase transitions
Rare events, activated processes, simulation of a crossing of a free-energy barrier
Metadynamics and its application to various systems

Recommended literature:

James P. Sethna: Statistical Mechanics: Entropy, Order Parameters, and Complexity, 2nd edition CLARENDON PRESS OXFORD 2021
Michael P. Allen, Dominic J. Tildesley: Computer Simulation of Liquids, Oxford University Press; 2nd edition (2017)
D. Frenkel, B. Smit, Understanding molecular simulations From algorithms to applications, Academic Press 2nd edition (2001)
Kurt Binder, Dieter W. Heermann: Monte Carlo Simulation in Statistical Physics: An Introduction (Graduate Texts in Physics), Springer; 6th ed. 2019

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 29

A	B	C	D	E	FX
58,62	20,69	3,45	10,34	6,9	0,0

Lecturers: prof. Ing. Roman Martoňák, DrSc.

Last change: 19.01.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-204/22	Diagnostic Methods in Solid State Physics

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

Number of credits: 5

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
The evaluation of the course has a form of an oral exam, grading of which reflects the overall orientation of the student in the covered topics. Indicative evaluation scale: A 90%, B 80%, C 70%, D 60%, E 50%.
Scale of assessment (preliminary/final): 0/100

Learning outcomes:
By completing the course, students will gain an overview of selected analytical, spectroscopic and microscopic methods used for studies of solids in terms their structure, composition, surface topography and other properties.

Class syllabus:
Electron and ion optics, types of analyzers for analytical and spectroscopic methods.
Principles and description of methods:
- X-Ray photoelectron spectroscopy, Auger electron spectroscopy, UPS, IS
- X-ray and electron diffraction, small angle scattering and related methods
- Scanning and transmission electron microscopy and related methods (EDX, WDS, FIB)
- Scanning probe microscopy (STM, AFM, EFM, MFM, SSRM, KPFM)
and others.

Recommended literature:
Elektronová spektroskopia : Metody analýzy povrchů / F. Allmer ...[et al.]; editorka Ludmila Eckertová. Praha : Československá akademie věd , 1990
V.Valvoda, M.Polcarová, P. Lukáč, Základy strukturní analýzy, Karolinum, Praha, 1992, pp. 492, ISBN 80-7066-648-X
J. M.Zuo, J. C.H. Spence, Advanced Transmission Electron Microscopy, Springer, New York, NY, 2017, ISBN 978-1-4939-6605-9
J.F. Watts, J. Wolstenholme, An introduction to surface analysis by XPS and AES, John Wiley & Sons, 2003, pp. 212, ISBN 978-0-470-84713-8
Scanning probe microscopy and spectroscopy, ed. D.A.Bonnel, John Willey & Sons, New York, 2001, pp. 493, ISBN 0-471-24824-X

M.Birkholz, Thin film analysis by X-ray scattering, Wiley-VCH Verlag GmbH, Weinheim, 2006, pp. 356, ISBN 3-527-31052-5
T.L.Alford, L.C.Feldman, J.W.Mayer, Fundamentals of Nanoscale Film Analysis, Springer, 2007, pp. 336, ISBN 978-0-387-29260-1
E.Mayer, H.J.Hug, R.Bennewitz, Scanning Probe Microscopy: The Lab on a Tip, Springer, 2004, pp. 210, ISBN 3-540-43180-2

Languages necessary to complete the course:
Slovak in combination with English (some of the suggested readings are in English).

Notes:

Past grade distribution
Total number of evaluated students: 56

A	B	C	D	E	FX
58,93	28,57	8,93	3,57	0,0	0,0

Lecturers: doc. Ing. Maroš Gregor, PhD., doc. RNDr. Tomáš Plecenik, PhD., doc. RNDr. Tomáš Roch, Dr. techn., Mgr. Leonid Satrapinskyy, PhD., Mgr. Branislav Grančič, PhD.

Last change: 03.12.2021

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-920/22	Diploma Thesis Seminar

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:
Continuous assessment: homework and seminar presentations
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%

Learning outcomes:
Preparation for a successful diploma thesis defense

Class syllabus:
To teach students to present the achieved results of their professional work in a public forum, to lead a professional discussion, to process and present assigned professional issues related to the study focus.

Recommended literature:
Defines the supervisor of the diploma thesis

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 36

A	B	C	D	E	FX
88,89	2,78	5,56	2,78	0,0	0,0

Lecturers: doc. RNDr. Tomáš Plecenik, PhD.

Last change: 02.02.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KEF/2-FTL-991/22	**Course title:** Diploma Thesis and its Defense
Number of credits: 10	
Educational level: II.	
State exam syllabus:	
Last change:	
Approved by: prof. Ing. Roman Martoňák, DrSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-115/22	Electronic Circuits

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 4 / 2 **per level/semester:** 52 / 26
Form of the course: on-site learning

Number of credits: 8

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Continuous: Homework, 20%
Final: Project, 80%
The course will be classified provided that the student proves the fulfilment of obligations at the level of at least 51 %. The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics.
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
Students acquire essential knowledge on principles of electronic devices (passives, diodes, transistors, thyristors), linear circuit analysis, noise analysis, power and noise matching. They acquire skills on basic electronic circuitry design. They learn the principles of microwave techtique, signal propagation in waveguides and antennas, and impedance matching as well

Class syllabus:
Diodes, bipolar and FET transistors, thyristors – principles of operation, basic circuits and applications. OpAmps – basic circuits and applications. Passive and active RLC circuits. Linear circuit analysis – impulse, transient and frequency response. Stochastic signal analysis. Noise. Power, impedance and noise matching. Active filters, power amplifiers, precise amplifiers. Transmission line theory, waveguides, standing waves, load matching. Cavity and microstrip resonators. Antennas.

Recommended literature:
The Art of Electronics/P. Horowitz, P. Hill, Cambridge University Press, ISBN 978-0-521-37095-0
Physics of Semiconductor Devices/S. M. Sze, K. Ng, Wiley-Interscience (2006)
Elektronika veľmi vysokých frekvencií / Andrej Tirpák. Bratislava : Univerzita Komenského, 2001

Languages necessary to complete the course:
Slovak in combination with English (suggested readings in English)

Notes:

Past grade distribution
Total number of evaluated students: 57

A	B	C	D	E	FX
54,39	26,32	10,53	7,02	1,75	0,0

Lecturers: doc. RNDr. František Kundracik, CSc., doc. RNDr. Michal Maheľ, CSc.

Last change: 20.01.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-108/22	Electronic and Optical Properties of Solids

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 4 / 2 **per level/semester:** 52 / 26
Form of the course: on-site learning

Number of credits: 8

Recommended semester: 2.

Educational level: II.

Prerequisites:

Recommended prerequisites:
1-FYZ-452 Introduction to solid state physics

Course requirements:
homeworks + oral exam
A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 55/45

Learning outcomes:
The students will acquire a deeper understanding of the electronic band structure and of those experiments which provide basic information about it. They will gain a working knowledge of the method of second quantization. They will learn how the electronic properties of solids are affected by disorder, Coulomb interactions, as well as by the electron-phonon interaction. They will know what kind of information on solids can be obtained by means of various optical methods.

Class syllabus:
Semiclassical dynamics of electrons. Influence of disorder on the electronic states. Anderson localization in one-dimensional wires. Hall effect and cyclotron resonance. de Haas-van Alphen effect. Quantum Hall effect. Many-body problem and the second quantization. Coulomb gas of electrons. The Wigner, Mott, and Hubbard metal-insulator transition. Electron-phonon coupling. Dielectric function. Clausius-Mossotti formula and polarization catastrophy. Optical properties of ionic crystals. Interband transitions in insulators. Absorption due to excitons and impurity states. Luminescence and the Franck-Condon effect. Scattering of light and photoemission.

Recommended literature:
http://www.st.fmph.uniba.sk/~hlubina1/
Fundamentals of the Physics of Solids, Vols. 1-3, J. Sólyom, Springer 2007 - 2010
Fundamentals of Semiconductors, Yu P. Y. and M. Cardona, Springer, 2010
Condensed matter physics : Corrected printing / Michael P. Marder. New York : John Wiley, 2000
Kvazičástice v pevných látkách / Jan Celý. Brno : Vysoké učení technické VUTIUM, 2004

Languages necessary to complete the course:

english

Notes:

Past grade distribution
Total number of evaluated students: 47

A	B	C	D	E	FX
55,32	6,38	8,51	8,51	21,28	0,0

Lecturers: doc. RNDr. Richard Hlubina, DrSc.

Last change: 31.01.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-MXX-130/21	Elements of AI

Educational activities:
Type of activities: independent work
Number of hours:
per week: 25 **per level/semester:** 325
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 8.

Educational level: II.

Prerequisites:

Course requirements:
Passing the online course https://course.elementsofai.com/ (in Enlish or Slovak version).

Learning outcomes:
The student will get acquainted with selected basic concepts of artificial intelligence and their use in solving various practical tasks.

Class syllabus:
1. What is artificial intelligence: related areas, AI philosophy.
2. Troubleshooting and UI: Browsing and troubleshooting, browsing and games
3. Probability and chance, Bayes' theorem, naive Bayesian classification.
4. Machine learning: nearest neighbor classifier, regression.
5. Neural networks: basics, creation, modern techniques.
6. Consequences: on predicting the future, the effects of AI on society, summary.

Recommended literature:
Russell S., Norwig P. (2010). Artificial Intelligence: A Modern Approach, (3rd ed.), Prentice Hall. Available in faculty library.
Marsland S. (2015). Machine Learning: An Algorithmic Perspective, (2nd ed.), CRC Press.

Languages necessary to complete the course:
Slovak or English

Notes:
The course consists of 20 numerical and 5 text-based tasks. Numerical tasks are checked automatically, text-based tasks are evaluated anonymously by students.

Past grade distribution
Total number of evaluated students: 95

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

Lecturers: doc. RNDr. Mária Markošová, PhD., prof. Ing. Igor Farkaš, Dr., doc. RNDr. Martin Takáč, PhD.
Last change: 22.08.2021
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-MXX-130/21	Elements of AI

Educational activities:
Type of activities: independent work
Number of hours:
per week: 25 **per level/semester:** 325
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 7.

Educational level: II.

Prerequisites:

Course requirements:
Passing the online course https://course.elementsofai.com/ (in Enlish or Slovak version).

Learning outcomes:
The student will get acquainted with selected basic concepts of artificial intelligence and their use in solving various practical tasks.

Class syllabus:
1. What is artificial intelligence: related areas, AI philosophy.
2. Troubleshooting and UI: Browsing and troubleshooting, browsing and games
3. Probability and chance, Bayes' theorem, naive Bayesian classification.
4. Machine learning: nearest neighbor classifier, regression.
5. Neural networks: basics, creation, modern techniques.
6. Consequences: on predicting the future, the effects of AI on society, summary.

Recommended literature:
Russell S., Norwig P. (2010). Artificial Intelligence: A Modern Approach, (3rd ed.), Prentice Hall. Available in faculty library.
Marsland S. (2015). Machine Learning: An Algorithmic Perspective, (2nd ed.), CRC Press.

Languages necessary to complete the course:
Slovak or English

Notes:
The course consists of 20 numerical and 5 text-based tasks. Numerical tasks are checked automatically, text-based tasks are evaluated anonymously by students.

Past grade distribution
Total number of evaluated students: 95

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

Lecturers: doc. RNDr. Mária Markošová, PhD.

Last change: 22.08.2021
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-233/13	English Conversation Course (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., 3., 7., 9.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
tests, presentations, essays
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Continual improvement of all language skills focused on communication/speaking, listening comprehension and writing. The emphasis is on discourse, lexicology and morphology, word-bank broadening of communicational English as well as English for specific purposes appropriate for university students. This course is a follow up of the previously taught ESP course.

Class syllabus:
This course's focus is to broaden spoken/communicational English for students with B2/C1 level of English knowledge.

Recommended literature:
Appropriate study material is supplied based on the participants'level of English by the lecturer. (Sources- The Guardian, The Herald Morning Sun. The Nine News, The West Australian, BBC News and podcasts, CNN podcasts).

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 318

A	B	C	D	E	FX
77,36	8,81	4,4	1,26	0,94	7,23

Lecturers: Mgr. Aneta Barnes

Last change: 11.04.2024
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-234/13	English Conversation Course (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., 4., 8., 10.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
tests, oral presentations, essays
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Continual improvement of all language skills focused on communication/speaking, listening comprehension and writing. The emphasis is on discourse, lexicology and morphology, word-bank broadening of communicational/spoken English as well as English for specific purpose appropriate for university students. This course is a follow up of the Conversational English course 1.

Class syllabus:
This course's focus is to broaden spoken/communicational English for students with B2/C1 level of English knowledge(Upper-Intermediate/Lower Advanced).

Recommended literature:
Appropriate study material is supplied based on the participants'level of English by the lecturer. (Sources- The Guardian, The Herald Morning Sun. The Nine News, The West Australian, BBC News and podcasts, CNN podcasts).

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 201

A	B	C	D	E	FX
82,09	8,96	2,49	1,0	0,0	5,47

Lecturers: Mgr. Aneta Barnes

Last change: 11.04.2024
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-141/00	French Language (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., 7.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
French language is taught at two levels: beginner and intermediate. Students opt for one of them depending on whether they wish to obtain the fundamentals of the language or wish to maintain and/or improve previous knowledge of French.

Recommended literature:
Capelle Guy, Menand Robert: Le Nouveau taxi 1, Hachette FLE Paris, France 2009, ISBN 978-2-01-155548 - 9

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 499

A	B	C	D	E	FX
48,5	19,44	16,63	7,82	2,0	5,61

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-142/00	French Language (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., 8.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
The subject continues the program of French language (1) and provides courses of essential and intermediate French language.

Recommended literature:
Capelle Guy, Menand Robert: Le Nouveau taxi 1, Hachette FLE Paris, France 2009, ISBN 978-2-01-155548 - 9

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 307

A	B	C	D	E	FX
45,6	22,48	16,94	8,79	2,28	3,91

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-241/00	French Language (3)

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., 9.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
The subject provides a course of intermediate French language, covering not only general, but also technical language.

Recommended literature:
Capelle Guy, Menand Robert: Le Nouveau taxi 1, Hachette FLE Paris, France 2009, ISBN 978-2-01-155548 - 9

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 128

A	B	C	D	E	FX
48,44	24,22	17,19	5,47	0,78	3,91

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-242/00	French Language (4)

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., 10.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
The subject provides a course of intermediate French covering not only general, but also technical French language.

Recommended literature:
Menand Robert: Le Nouveau taxi 2, Hachette FLE, Paris, France 2009, ISBN 978-2-01-155551 - 9

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 79

A	B	C	D	E	FX
43,04	32,91	16,46	2,53	1,27	3,8

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-151/00	German Language (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., 7.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
To master the fundamentals of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency)

Class syllabus:
German language is taught at three levels: beginner, intermediate and advanced. Students opt for one of them depending on whether they need to learn the fundamentals or maintain and/or improve their previous knowledge.
This course's focus is to master the fundamentals of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency)

Recommended literature:
Appropriate study material is supplied by teacher based on the participants'level of German proficiency.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 874

A	B	C	D	E	FX
38,33	24,71	18,42	8,81	2,86	6,86

Lecturers: Mgr. Alexandra Maďarová, Mgr. Simona Dobiašová, PhD.

Last change: 05.09.2025

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-152/00	German Language (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., 8.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
To master the fundamentals of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency)

Class syllabus:
German language is taught at two levels: beginner and intermediate. Students opt for one of them depending on whether they wish to obtain the fundamentals of the language or wish to maintain and/or improve previous knowledge of German.
This course’s focus is to to master the fundamentals of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency)

Recommended literature:
Appropriate study material is supplied by teacher based on the participants’level of German proficiency

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 542

A	B	C	D	E	FX
38,01	19,56	19,56	12,36	3,51	7,01

Lecturers: Mgr. Alexandra Maďarová, Mgr. Simona Dobiašová, PhD.

Last change: 05.09.2025

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-251/00	German Language (3)

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., 9.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Master the basics of general language and basic professional terminology of individual fields of study (depending on the advanced level of students)

Class syllabus:
The course is a follow-up to the German language (1,2). The subject provides a course of intermediate or advanced German language.
This course's focus is to deepen the knowledge of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency).

Recommended literature:
Appropriate study material is supplied by teacher based on the participants'level of German proficiency.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 191

A	B	C	D	E	FX
45,03	23,04	19,37	6,81	2,09	3,66

Lecturers: Mgr. Alexandra Maďarová, Mgr. Simona Dobiašová, PhD.

Last change: 05.09.2025

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-252/00	German Language (4)

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., 10.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Master the basics of general language and basic professional terminology of individual fields of study (depending on the advanced level of students)

Class syllabus:
The course is a follow-up to the German language (1-3). It provides a course of intermediate and advanced German language.
This course's focus is to deepen the knowledge of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency).

Recommended literature:
Appropriate study material is supplied by teacher based on the participants'level of German proficiency.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 104

A	B	C	D	E	FX
44,23	22,12	14,42	10,58	3,85	4,81

Lecturers: Mgr. Alexandra Maďarová, Mgr. Simona Dobiašová, PhD.

Last change: 05.09.2025

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-122/22	Individual Work on Diploma Thesis (1)

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: 5

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Interim evaluation: monitoring the implementation of the set stages
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%

Learning outcomes:
Acquisition of practical knowledge and habits for independent scientific work, preparation of diploma thesis

Class syllabus:
Solving selected tasks related to the specialization of the student and the topic of the diploma thesis according to the recommendation of the thesis supervisor.

Recommended literature:
Defines the supervisor of the diploma thesis

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 27

A	B	C	D	E	FX
96,3	0,0	3,7	0,0	0,0	0,0

Lecturers: prof. RNDr. Peter Kúš, DrSc.

Last change: 02.02.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-221/22	Individual Work on Diploma Thesis (2)

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: 5

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Interim evaluation: monitoring the implementation of the set stages
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%

Learning outcomes:
Acquisition of practical knowledge and habits for independent scientific work, preparation of diploma thesis

Class syllabus:
Solving selected tasks related to the specialization of the student and the topic of the diploma thesis according to the recommendation of the thesis supervisor.

Recommended literature:
Defines the supervisor of the diploma thesis

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 28

A	B	C	D	E	FX
96,43	3,57	0,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Peter Kúš, DrSc.

Last change: 02.02.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KDMFI+KAI/2-MXX-131/21	International Team-based Research Project

Educational activities:
Type of activities: course / independent work
Number of hours:
per week: 3 **per level/semester:** 39 / 30s
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 1., 7.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: active participation in research in an international student team (25%), presentation of work in a workshop (25%), scientific article (50%)
Indicative evaluation scale: A 90 %, B 80 %, C 70 %, D 60 %, E 50 %
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students will learn in the team to agree on a common research topic, formulate research questions, determine research methods for the problem, collect and evaluate data, discuss their findings, present research results to the professional public, analyze and evaluate the scientific work of their colleagues, prepare a scientific article suitable for publication

Class syllabus:
- Research methodology
- Design and implementation of a research project in an international group (preferably interdisciplinary)
- Methods and tools for collaboration in virtual space, collaboration in science and practice
- Academic writing, presentation of research results through scientific articles; objectives, content and structure of scientific articles; forms of academic publication, publication forums and evaluation of their quality
- Quality assurance and feedback - peer review
- Communication of results through posters or conference presentations

Recommended literature:
- Teachers' own electronic study materials published on the course website or in the Moodle system
- Gavora, Peter a kol. 2010. Elektronická učebnica pedagogického výskumu. [online]. Bratislava : Univerzita Komenského, 2010. Dostupné na: http://www.e-metodologia.fedu.uniba.sk/ ISBN 978–80–223–2951–4.

- Tharenou, P., Donohue, R. and Cooper, B., 2007. Management research methods. Cambridge University Press.
- Topping, A., 2015: The Quantitative-Qualitative Continium. In: Gerrish, K. and Lathlean, J., The Research Process in Nursing, p. 159-172
- Williamson, K. and Johanson, G. eds., 2017. Research methods: Information, systems, and contexts. Chandos Publishing.

Languages necessary to complete the course:
English

Notes:

Past grade distribution
Total number of evaluated students: 9

A	B	C	D	E	FX
77,78	0,0	0,0	0,0	22,22	0,0

Lecturers: doc. RNDr. Zuzana Kubincová, PhD., doc. RNDr. Martin Homola, PhD.

Last change: 22.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-117/22	Laboratory Practice in Solid State Physics

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

Number of credits: 4

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Continuous: protocols plus final project
Scale of assessment (preliminary/final): Partial protocols, 60% Final: Project, 40% The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics.

Learning outcomes:
Students will apply the knowledge from lectures “Optical and Electrical Properties of Solids and Physics of Semiconductor and Semiconductor Devices”. Students will gain the appropriate practical experiences from thin film preparations and characterizations. (Basically – resistivity, mobility, band gap etc.) The prepared thin films in consequence will use to process electronic device as transistor, diode, Hall probe or sensor. Finally they characterize the prepared device.

Class syllabus:
The selection of material and prepared device we will decided in the beginning of semester in connection to actual problems solved at the department.
Epitaxial film growth (MOCVD, ALD, PLD)- Thickness and composition evaluation.
Lattice mismatch estimation (XRD)
Optical and electrical properties measurements (transmission , reflection (Eg), Pauw)
Photoluminescence measurements
Thin oxide films (thermal oxidation process or ALD growth)
Metal thin films prepared by evaporation or by sputtering.
Processing of devices – techniques of lithography.
Optical/Electron beam/AFM microscopy.
Devices characterization measurements

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 49

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

Lecturers: RNDr. Ján Greguš, PhD.

Last change: 27.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-206/22	Low Temperature Physics

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

Number of credits: 5

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
The evaluation of the course will be in the form of oral exam (1/2-1 h), its successful completion reflects the student knowledge of physical methods and technologies used in low temperature physics and his ability to use this knowledge in realization of sensitive physical measurements. The student should demonstrate his skills to operate the microwave and vacuum devices as well as to manipulate cryogenic liquids and materials at low temperatures safely. Grade: A 90%, B 80%, C 70%, D 60%, E 50%.
Scale of assessment (preliminary/final): 45/55

Learning outcomes:
The student who completes the course successfully will be able to work with standard refrigerators and measurement devices (high-frequency and microwave devices, thermometry, vacuum technology). He or she will be able to demonstrate a solid knowledge of the main principles of: a) low temperature physics, b) measurement of low-level signals including quantum-limited one.

Class syllabus:
Properties of Cryoliquids. Solid Matter at Low Temperatures. Thermal Expansion and conductivity. Thermal Contact and Thermal Isolation. Cryostats and Helium Refrigerators. Adiabatic Demagnetization. Low-temperature thermometry. Measurements at low temperatures. Quantum measurements at low temperatures.

Recommended literature:
1. Frank Pobell, Matter and Methods at Low Temperatures, Springer 2007, https://link.springer.com/book/10.1007/978-3-540-46360-3
2. Anthony Kent, Experimental low- temperature physics, THE MACMILLAN PRESS LTD 2007, https://link.springer.com/book/10.1007/978-1-349-22736-5
3. G. Ventura and L. Risegari, The Art of Cryogenics Low-Temperature Experimental Techniques, Elsevier 2007, https://www.elsevier.com/books/the-art-of-cryogenics/ventura/978-0-08-044479-6

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 7

A	B	C	D	E	FX
28,57	42,86	28,57	0,0	0,0	0,0

Lecturers: prof. RNDr. Miroslav Grajcar, DrSc., Mgr. Pavol Neilinger, PhD.

Last change: 01.02.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-203/22	Magnetic Properties of Solids and Superconductivity

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 4 / 2 **per level/semester:** 52 / 26
Form of the course: on-site learning

Number of credits: 8

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuous: Homework, 20%
Final: Project, 80%
The course will be classified provided that the student proves the fulfilment of obligations at the level of at least 51 %. The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics.
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
Students acquire essential knowledge of the theory of magnetic phenomena and superconductivity, and their applications as well.

Class syllabus:
Phase transitions in solids. Electronic structure of atoms. Diamagnetism and paramagnetism. Ferromagnetism and other types of magnetic ordering. Properties of hard magnetics. Magnetic resonances. Basics of spintronics. Phenomenological theories of superconductivity. Microscopic theory of superconductivity. Type II superconductivity. Josephson phenomena. Applications of magnetism and superconductivity.

Recommended literature:
Magnetizačné procesy / Vladimír Hajko, Ladislav Potocký, Anton Zentko. Bratislava : Alfa, 1982
Solid state physics / Neil W. Ashcroft, N. David Mermin. Fort Worth : Harcourt Brace, 1976
Supravodivosť / Pavol Valko. Zlín : Kniha Zlín, 2011
Introduction to superconductivity / Michael Tinkham, Gordon McKay. Mineola : Dover, 2004

Languages necessary to complete the course:
Slovak in combination with English (suggested readings in English)

Notes:

Past grade distribution Total number of evaluated students: 41					
A	B	C	D	E	FX
65,85	4,88	7,32	9,76	12,2	0,0
Lecturers: doc. RNDr. Michal Maheľ, CSc.					
Last change: 09.02.2022					
Approved by: prof. Ing. Roman Martoňák, DrSc.					

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-205/22	Many-body Physics

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 4 / 2 **per level/semester:** 52 / 26
Form of the course: on-site learning

Number of credits: 8

Recommended semester: 3.

Educational level: II.

Prerequisites: FMFI.KEF/2-FTL-108/22 - Electronic and Optical Properties of Solids

Recommended prerequisites:
2-FTL-107 Structure and mechanical properties of solids

Course requirements:
homeworks and oral exam: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 55/45

Learning outcomes:
The students will be acquainted with the notions of effective model and renormalization group. They will have a deeper understanding of the notions of the physical vacuum and elementary excitation. They will also understand how spontaneous symmetry breaking and its defects determine physical properties of condensed matter. They will gain basic information about the role of topology in modern condensed matter physics.

Class syllabus:
Effective models. Symmetries and conservation laws. Heisenberg model: exact results, spontaneous symmetry breaking. Goldstone modes. Generalized rigidity. XY model and the quantum spin liquid. Kosterlitz-Thouless transition. Superfluid helium: basic experimental facts, Josephson equations, Bogoliubov theory. Superconductivity: basic experimental facts, effective model, Cooper instability and renormalization group. BCS theory. Thermodynamics and spectroscopy of superconductors. Topological defects. Topological insulators.

Recommended literature:
http://www.st.fmph.uniba.sk/~hlubina1/
Statistical mechanics : Entropy, order parameters, and complexity / James P. Sethna. Oxford University Press, 2006
Condensed matter physics : Corrected printing / Michael P. Marder. John Wiley, 2000
Basic notions of condensed matter physics / P. W. Anderson, Addison Wesley, 1984

Languages necessary to complete the course:
english

Notes:

Past grade distribution Total number of evaluated students: 19					
A	B	C	D	E	FX
68,42	10,53	15,79	0,0	5,26	0,0
Lecturers: doc. RNDr. Richard Hlubina, DrSc.					
Last change: 31.01.2022					
Approved by: prof. Ing. Roman Martoňák, DrSc.					

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-114/22	Measurement Methods in Solid State Physics

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: 4

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
The evaluation of the course has a form of an oral exam, grading of which reflects the overall orientation of the student in the covered topics. Indicative evaluation scale: A 90%, B 80%, C 70%, D 60%, E 50%.
Scale of assessment (preliminary/final): 0/100

Learning outcomes:
By completing the course, students will gain an overview of selected electrical, magnetic and optical measurement methods used for characterization of properties of solids.

Class syllabus:
Conductivity and contact phenomena. DC methods of measuring resistance and conductivity - probe methods, Van der Pauw method. Arrhenius plot – determination of activation energies. Measurement of very small currents and voltages. Hall effect. AC measurements - phase sensitive signal detection, Lock-in, measurement of differential (dI(V)/dV) characteristics, tunneling spectroscopy, impedance spectroscopy. AC susceptibility measurements. Kelvin probe measurements. Noises - intrinsic and extrinsic noises, capacitive and inductive coupling, shielding, grounding, noises in amplifiers. Measurement of lifetime, mobility and diffusion length of minority charge carriers by optical methods. Femtosecond spectroscopy - pump-probe measurement. Temperature measurement methods.

Recommended literature:
J.Brož a kol., Základy fysikálních měření (I), SPN, Praha, 1967, pp.532.
J.Brož a kol., Základy fysikálních měření (II)A, SPN, Praha, 1974, pp.295.
J.Brož a kol., Základy fysikálních měření (II)B, SPN, Praha, 1974, pp.756.
K. V. Šalimová, Fyzika polovodičov, Bratislava, 1978, pp. 448
Ralph Morrison, Grounding and Schielding Techniques, 4th edition, John Willey&Sons, Inc., New York, 1998, pp. 201, ISBN 0-471-24518-6.
Henry W. Ott, Noise Reduction Techniques in Electronic Systems, 2nd edition, John Wiley & Sons, New York, 1988, pp.426, ISBN 0-471-85068-3.
J.Jelínek, Z.Málek, Kryogenní technika, SNTL, Praha, 1982, pp.354.

V.Matuáš, Elektronické měžicí přistroje, SNTL/ALFA, Praha, 1981, pp.402.
L. Michalski, K. Eckersdorf, J. Kucharski, J. McGhee, Temperature measurement, 2nd edition, John Wiley & Sons, New York, 2000, ISBN 0-471-86779-9
A.S. Morris, Measurement and Instrumentation principles, Elsevier, Amsterdam, 2001, pp.475, ISBN 0-7506-5081-8
R.B. Northrop, Introduction to instrumentation and measurement, Taylor&Francis, London, 2005, pp.743, ISBN 0-8493-3773-9
E.L.Wolf: Principles of Electron Tunneling Spectroscopy, Oxford University Press, New York, 1989, pp.576.
KEITHLEY: Nanotechnology Measurement Handbook
KEITHLEY: Making precision Low Current and High Resistance Measurements

Languages necessary to complete the course:
Slovak in combination with English (some of the suggested literature is in English)

Notes:

Past grade distribution
Total number of evaluated students: 57

A	B	C	D	E	FX
54,39	24,56	19,3	1,75	0,0	0,0

Lecturers: doc. RNDr. Tomáš Plecenik, PhD.

Last change: 03.12.2021

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-224/22	Mesoscopic Physics and Quantum Electronics

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 4 / 1 **per level/semester:** 52 / 13
Form of the course: on-site learning

Number of credits: 7

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
written test during the course – weight 30 %,
written and oral exam – weight 70 %.
Evaluation A – at least 90 %, B – at least 80 %, C – at least 70 %, D – at least 60 %, E – at least 50 %.
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
After completing the course the student will gain knowledge of basic theoretical methods and experimental facts from the field of quantum electron transport in mesoscopic systems. He/she will be able to understand physical principles of nanoelectronics devices at the edge of miniaturization.

Class syllabus:
Definition of mesoscopic system. Two-terminal conductance of disordered mesoscopic system – Landauer formula. Fundamental quantization of ballistic conductance. Coherent conductance of disordered one-dimensional wire – strong localization, giant conductance fluctuations, conductance distribution. Weak localization and universal conductance fluctuations. Multiterminal conductance of disordered mesoscopic system – Büttiker equations, effect of measurement on the measured coherent conductance. Quantum Hall effect. Mesoscopic ring connected to leads, electronic Bohm-Aharonov effect and parallel connection of quantum resistors in the scattering matrix formalism. Single-electron tunneling through a weak link and through a series of weak links, Coulomb blockade, single-electron transistor.

Recommended literature:
S. Datta, Electronic Transport in Mesoscopic Systems (Cambridge University Press, Cambridge, UK, 1995)
Y. Imry, Introduction to Mesoscopic Physics (Oxford University Press, Oxford, UK, 2002)
M. Moško a A. Mošková , Introduction into mesoscopic physics (in Slovak language), http://kflin.elf.stuba.sk/~ballo/SimLab/skripta

Languages necessary to complete the course:
The course is held in Slovak (in English when necessary)

Notes:

Past grade distribution
Total number of evaluated students: 27

A	B	C	D	E	FX
59,26	22,22	14,81	0,0	3,7	0,0

Lecturers: doc. RNDr. Martin Moško, DrSc.

Last change: 01.02.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-MXX-132/23	Participation in Empirical Research

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

Number of credits: 2

Recommended semester: 2., 8.

Educational level: I., I.II., 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: 202

A	B	C	D	E	FX
89,6	1,49	1,49	0,0	2,97	4,46

Lecturers: Mgr. Xenia Daniela Poslon, PhD.

Last change: 06.09.2023

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-MXX-132/23	Participation in Empirical Research

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

Number of credits: 2

Recommended semester: 1., 7.

Educational level: I., I.II., 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: 202

A	B	C	D	E	FX
89,6	1,49	1,49	0,0	2,97	4,46

Lecturers: Mgr. Xenia Daniela Poslon, PhD.

Last change: 06.09.2023

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-110/00	Physical Education and Sport (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., 7.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
Practicing of the students´ game skills in collective sports: basketball, volleyball, football, floorball and hockey. Mastering of the basic technique of a particular sport discipline in other sports. In paddling, basic training on still and slightly flowing water. Development of coordination skills, improvement of articular mobility and cardiovascular system.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 2007

A	B	C	D	E	FX
97,41	0,6	0,1	0,0	0,0	1,89

Lecturers: PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, Mgr. Jana Leginusová, Mgr. Tomáš Kuchár, PhD., PaedDr. Mikuláš Ortutay, Mgr. Martin Dovičák, PhD., Mgr. Júlia Raábová, PhD., Mgr. Branislav Nedbálek, PhD., Mgr. Tomáš Lovecký, Mgr. Martina Maheľová, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-120/00	Physical Education and Sport (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., 8.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
Practicing of offensive and defensive game combinations and playing with modified rules in collective sports such as basketball, volleyball, football, floorball, hockey. Command of elements of higher difficulty in locomotion skills (swimming - crawl stroke, breast stroke, butterfly stroke, trampoline jumping and aerobics – practicing of areobics compositions, bodybuilding – development of the main muscle groups, paddling on running water. Testing of the level of physical fitness and coordination skills.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 1797

A	B	C	D	E	FX
98,44	0,33	0,06	0,06	0,06	1,06

Lecturers: Mgr. Martin Dovičák, PhD., Mgr. Tomáš Kuchár, PhD., Mgr. Jana Leginusová, PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, Mgr. Branislav Nedbálek, PhD., PaedDr. Mikuláš Ortutay, Mgr. Júlia Raábová, PhD., Mgr. Tomáš Lovecký, Mgr. Martina Maheľová, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-210/00	Physical Education and Sport (3)

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., 9.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
To improve offensive and defensive game combinations in collective sports. Practicing of tactical and technical elements in individual sports. Compensatory exercises to correct wrong body posture. Stretching. Competition rules in sport disciplines.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 1525

A	B	C	D	E	FX
98,36	0,39	0,07	0,0	0,07	1,11

Lecturers: PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, Mgr. Jana Leginusová, Mgr. Tomáš Kuchár, PhD., PaedDr. Mikuláš Ortutay, Mgr. Martin Dovičák, PhD., Mgr. Júlia Raábová, PhD., Mgr. Branislav Nedbálek, PhD., Mgr. Tomáš Lovecký, Mgr. Martina Maheľová, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-220/00	Physical Education and Sport (4)

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., 10.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
Sport training for Faculty Championships in a selected sport with modified rules. Selection of sport-talented students into teams of the Faculty Sport League, University League of Bratislava Faculties, and participation in sport events of the Faculty and University.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 1267

A	B	C	D	E	FX
98,34	0,39	0,08	0,08	0,08	1,03

Lecturers: PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, Mgr. Jana Leginusová, Mgr. Tomáš Kuchár, PhD., PaedDr. Mikuláš Ortutay, Mgr. Martin Dovičák, PhD., Mgr. Branislav Nedbálek, PhD., Mgr. Júlia Raábová, PhD., Mgr. Tomáš Lovecký, Mgr. Martina Maheľová, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-109/22	Physical Methods of Thin Films Preparation

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

Number of credits: 5

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Mid-term evaluation: homeworks, presentation
Exam: oral
It is necessary to obtain at least 90% of points to obtain A grade, at least 80% of points to grade B, at least 70% of points to grade C, at least 60% of points to grade D and at least 50% to grade E.
Scale of assessment (preliminary/final): Exam weight in rating: 20/80

Learning outcomes:
The student will first get acquainted with the technical possibilities of achieving vacuum, its measurement and control of working gases. He will gain a comprehensive knowledge of physical methods of preparation of thin films (evaporation, sputtering, arc evaporation, pulsed laser deposition), where he will be explained in detail the physical aspects of the processes. The student will gain information about the growth of thin films, the influence of deposition parameters on the structure and properties of films. In the last part he will be introduced to the possibilities of creating functional structures in films using ion treatment and lithographic methods.

Class syllabus:
vacuum pumps, scales and flow controllers, Langmuir probe, mass spectroscopy, evaporation, DC and RF sputtering, magnetron, glow discharge, plasma parameters, high energy pulses (HiPPMS), pulsed laser deposition, laser optics, ablation mechanism, arc evaporation, cathode macroparticle filtering, thin film growth, surface energy, thermodynamic nucleation model, zonal models, texture, epitaxy, focused ion beam, nanotubes, electron lithography, optical lithography

Recommended literature:
M. Ohring: Materials Science of Thin Films – Deposition and Structure, Academic Press, 2002
D.L. Smith, Thin film deposition, principles and practice, McGraw-Hill, 1995
P. M. Martin: Handbook of Deposition Technologies for Films and Coatings, Elsevier, 2005

Languages necessary to complete the course:
slovak, english

Notes:

Past grade distribution
Total number of evaluated students: 35

A	B	C	D	E	FX
94,29	5,71	0,0	0,0	0,0	0,0

Lecturers: doc. Ing. Marián Mikula, PhD., Mgr. Branislav Grančič, PhD., Mgr. Leonid Satrapinskyy, PhD.

Last change: 20.01.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-119/22	Physical metallurgy

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.

Educational level: II.

Prerequisites:

Recommended prerequisites:
Structure and mechanical properties of solids (2-FTL-107/15)

Course requirements:
Exam: written
Exam weight in rating: 0%
It is necessary to obtain at least 90% of points to obtain A grade, at least 80% of points to grade B, at least 70% of points to grade C, at least 60% of points to grade D and at least 50% to grade E.

Learning outcomes:
Course objectives:
In the first part, the student will gain knowledge in the field of phase transformations in technical materials. They will get acquainted with the formation of solid solutions, with nucleation and conditions of intergrain interfaces and their influence on the shape of crystals, with their temperature stability, with the influence of point defects on the structure of solid solutions. He will also gain knowledge about solidification of alloys, diffusion and non-diffusion transformations, shape memory and decomposition mechanisms, precipitation. In the second part, they will get acquainted with the conditions of deformation behavior of alloys, with the influence of dislocations and surface defects on the strengthening of materials. The student will understand the concept of nanostructured materials from the point of view of mechanical behavior and will also gain a comprehensive idea of fracture mechanics, material creep and material fatigue.

Class syllabus:
Point defects in lattices, solid solutions, nucleation, surface strains, Wulff shape. Phase transitions in solid solutions. Solidification, dendrites. Peritectic, monotectic, eutectic, eutectoid transformations. TTT diagrams, martensitic transformation. Intermediate phases. Steels, alloying. Precipitation, spinodal decomposition in alloys, phase segregation. Dislocation mechanisms. Deformation mechanisms, strengthening. Tensile test. Stacking faults, Grain boundaries. Fracture mechanics, creep, material fatigue.

Recommended literature:
Úvod do materiálového inžinierstva I/ R. Moravčík a kol. MTF STU, 2015

Fázové přeměny/ V. Vodárek TU Ostrava, 2013
Physical Metallurgy/ D. Laughlin, Elsevier 2014

Languages necessary to complete the course:
Slovak in combination with English (suggested readings in English)

Notes:

Past grade distribution
Total number of evaluated students: 8

A	B	C	D	E	FX
75,0	12,5	12,5	0,0	0,0	0,0

Lecturers: doc. Ing. Marián Mikula, PhD.

Last change: 20.01.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-124/24	Physics of semiconductors and semiconductor devices

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

Number of credits: 5

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
written test during the course – weight 30 %,
written and oral exam – weight 70 %.
Evaluation A – at least 90 %, B – at least 80 %, C – at least 70 %, D – at least 60 %, E – at least 50 %.
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
After completing the course the student will gain basic theoretical knowledge on the electrical and optical properties of semiconductors and semiconductor devices.

Class syllabus:
Band structure of semiconductors, statistics of electrons and holes in the intrinsic and doped semiconductors, carrier scattering by impurities and lattice vibrations – carrier mobility. Conductivity of semiconductors in strong electric fields – solution of the Boltzmann transport equation by Monte Carlo simulation. Excess carriers, optical absorption, photoluminescence, carrier life time. Diffusion, drift, and recombination of excess carriers, Haynes-Shockley experiment. Equilibrium state and current-voltage characteristic of the p-n junction and Schottky junction, rectifying and ohmic Schottky junction, modulation-doped semiconductor heterojunction – two-dimensional electrons with high mobility, resonant tunneling diode. Bipolar transistor, field effect transistor, high-electron-mobility transistor. Optoelectronics devices – photodiode, solar cell, photodetector, LED, semiconductor laser.

Recommended literature:
B. K Ridley, Quantum Processes in Semiconductors,Oxford University Press, 5th edition 2013
Karl Hess, Advanced theory of semiconductor devices, New York, NY. IEEE Press. 2000.
B. G. Streetman, S. J. Banerjee, Solid State Electronics Devices, Pearson Education Inc. 2006

Languages necessary to complete the course:
The course is held in Slovak (in English when necessary)

Notes:

Past grade distribution
Total number of evaluated students: 8

A	B	C	D	E	FX
62,5	0,0	37,5	0,0	0,0	0,0

Lecturers: doc. RNDr. Martin Moško, DrSc.

Last change: 26.08.2024

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-118/22	Quantum Mechanics - Atoms, Molecules and Symmetries

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 3 / 2 **per level/semester:** 39 / 26
Form of the course: on-site learning

Number of credits: 7

Recommended semester: 1.

Educational level: II.

Prerequisites:

Recommended prerequisites:
Introduction to Condensed Matter Physics

Course requirements:
Midterm evaluation: homeworks.
Exam: oral or written.
Indicative evaluation scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 55/45

Learning outcomes:
After completing the course, students will know the basic methods and approaches in solving the quantum mechanical (multiparticle) problem of atoms and molecules heavier than a hydrogen atom. The subject is a natural bridge in understanding simple quantum mechanical structures on the one hand and crystalline solids on the other. The aim is also to get acquainted with the role of discrete symmetries in the mentioned structures.

Class syllabus:
Born - Oppenheimer approximation. Indistinguishability of particles - fermions, bosons. Slater's determinant. Hartree-Fock method. He atom. Aufbau principle and periodic table of elements. Spin-orbital interaction. Double atom molecule. Chemical bonding. H2 + molecule. Molecule H2. Valence layer. Molecular orbitals. Sigma and Pi orbitals. Single and multiple links. Electronegativity. Homonuclear and heteronuclear molecules. Multiatomic molecules. Hybridizations of sp2, sp3. Molecule geometry. Bonding in crystals - the transition from molecule to crystal. Introduction to the theory of discrete groups. Characters. Group representations. Decomposition into irreducible representations. Demonstrations on various examples - cleavage in a crystal field. Vibration states. Jahn-Teller effect. Aspects of group theory on the example of carbon nanotubes.

Recommended literature:
Ostlund, Szabo - Modern Quantum Chemistry: Introduction to Advanced Electronic Structure Theory
Dekock, Grey - Chemical Structure and Bonding

David M. Bishop - Group Theory and Chemistry
Walter A. Harrison - Electronic Structure and the Properties of Solids: The Physics of the Chemical Bond
Mildred S. Dresselhaus, Gene Dresselhaus, Ado Jorio: Group Theory - Application to the Physics of Condensed Matter

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 16

A	B	C	D	E	FX
68,75	18,75	12,5	0,0	0,0	0,0

Lecturers: prof. Ing. Roman Martoňák, DrSc., Mgr. František Herman, PhD.

Last change: 21.01.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-161/00	Russian Language (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., 7.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Basic communication in Russian, developing other Russian language skills - listening comprehension, reading and writing.

Class syllabus:
To master the fundamentals of general Russian. The language level is A1.
Learning the Cyrillic (Russian) alphabet, gaining basic language competence, building up skills and confidence in dealing with unfamiliar authentic and semi-authentic texts.
The subject provides a course in Russian language for beginners.

Recommended literature:
The textbook: : Точка Ру A1 (Ольга Долматова, Екатерина Новачац), pracovné karty Падежи 1 (Л.С. Безкоровайная, В.Е. Штыленко).

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 746

A	B	C	D	E	FX
57,77	16,62	11,13	4,16	1,74	8,58

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-162/00	Russian Language (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., 8.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Basic communication in Russian, developing other Russian language skills - listening comprehension, reading and writing.

Class syllabus:
To master the fundamentals of general Russian.
Learning the Cyrillic (Russian) alphabet, gaining basic language competence, building up skills and confidence in dealing with unfamiliar authentic and semi-authentic texts.
The subject continues the program of Russian language (1) and provides a course of Russian for beginners.

Recommended literature:
Textbook: Точка Ру A1 (Ольга Долматова, Екатерина Новачац), pracovné karty Падежи 1 (Л.С. Безкоровайная, В.Е. Штыленко).

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 435

A	B	C	D	E	FX
63,91	16,09	8,97	3,91	0,92	6,21

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-261/00	Russian Language (3)

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., 9.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Basic communication in Russian, developing other Russian language skills - listening comprehension, reading and writing.

Class syllabus:
Learning the handwritten Russian (Russian Cursive Cyrillic), developing further language skills, gaining knowledge of Russian culture, history and way of life, pre-intermediate to intermediate grammar and vocabulary.
The course "Russian for Intermediate Students" is a follow-up to "Russian for Beginners". The subject of the course is general Russian in the range appropriate to the given level.

Recommended literature:
Точка Ру A2 (Ольга Долматова, Екатерина Новачац) a Short Stories in Russian (Olly Richards, Alex Rowlings)

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 215

A	B	C	D	E	FX
68,84	17,67	9,3	2,33	0,0	1,86

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-262/00	Russian Language (4)

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., 10.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Learning the handwritten Russian (Russian Cursive Cyrillic), developing further language skills, gaining knowledge of Russian culture, history and way of life, pre-intermediate to intermediate grammar and vocabulary.

Class syllabus:
Learning the handwritten Russian (Russian Cursive Cyrillic), developing further language skills, gaining knowledge of Russian culture, history and way of life, pre-intermediate to intermediate grammar and vocabulary.
The course "Russian for Intermediate Students" is a follow-up to "Russian for Beginners". The subject of the course is general Russian in the range appropriate to the given level.

Recommended literature:
Точка Ру A2 (Ольга Долматова, Екатерина Новачац) a Short Stories in Russian (Olly Richards, Alex Rowlings)

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 153

A	B	C	D	E	FX
74,51	14,38	7,19	2,61	0,65	0,65

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/2-FTF-114/00	Selected Parts of Advanced Statistical Physics

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 4 / 2 **per level/semester:** 52 / 26
Form of the course: on-site learning

Number of credits: 8

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: homeworks
Exam: oral exam
A: 100-90, B: 89-80, C: 79-70, D: 69-60, E: 59-50, Fx: 49-0.
Scale of assessment (preliminary/final): 80/20

Learning outcomes:
Acquire advanced techniques of statistical physics. Namely
- probability theory techniques related to normal distribution
- elements of hypothesis testing
- the relationship between quantum and classical statistical physics
- the relationship between thermodynamics and statistical physics
- basic knowledge of phase transitions
- orientation in techniques of physical kinetics

Class syllabus:
Mathematical statistics, elements of information theory, general formalism of quantum statistical physics, numerical methods, variation principles, phase transitions, spin models, kinetic equations, transport phenomena, theory of fluctuations, random processes.

Recommended literature:
L. E. Reichl, A modern course in statistical physics
David Tong, Statistical Physics
V.Černý, M.Medo: Selected topics from statistical physics, elektronický text na web stránke predmetu

Languages necessary to complete the course:

Notes:

Past grade distribution Total number of evaluated students: 117					
A	B	C	D	E	FX
62,39	30,77	2,56	1,71	2,56	0,0
Lecturers: doc. Mgr. Samuel Kováčik, PhD.					
Last change: 15.06.2022					
Approved by: prof. Ing. Roman Martoňák, DrSc.					

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-171/20	Slovak Language for Foreign Students (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., 7.

Educational level: I., I.II., II., III.

Prerequisites:

Course requirements:
tests
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
This course is aimed for foreign students to learn the fundamentals of the Slovak language with the focus on basic communication as well as all other language skills- listening comprehension,reading and writing.

Class syllabus:
The sylabus is targeted at the comprehension of the basics of the Slovak language for the absolute beginners (A1).

Recommended literature:
Krížom- Krážom Slovenčina 1, additional material to further support the covered topics.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 155

A	ABS	B	C	D	E	FX	NEABS
40,65	21,29	7,1	4,52	0,65	1,29	21,29	3,23

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-172/20	Slovak Language for Foreign Students (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., 8.

Educational level: I., I.II., II., III.

Prerequisites:

Course requirements:
tests
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
This course is aimed for foreign students to learn the fundamentals of the Slovak language with the focus on basic communication as well as all other language skills- listening comprehension,reading and writing.

Class syllabus:
The sylabus is targeted at the comprehension of the basics of the Slovak language for the absolute beginners (A1) and this course is a follow up course to the Slovak language course 1.

Recommended literature:
Krížom- Krážom Slovenčina 1, additional material to further support the covered topics

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 87

A	ABS	B	C	D	E	FX	NEABS
63,22	18,39	1,15	1,15	0,0	0,0	9,2	6,9

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-271/20	Slovak Language for Foreign Students (3)

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., 9.

Educational level: I., I.II., II., III.

Prerequisites:

Course requirements:
tests
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
This course is aimed for foreign students to better comprehend all the language skills important to enable correct usage of the Slovak language – listening comprehension, reading, writing and speaking.

Class syllabus:
The sylabus is targeted at the comprehension of all the language skills of the Slovak language , and it is a follow up course to the Slovak language course 2.

Recommended literature:
Krížom-Krážom Slovenčina 2, additional material to further support the covered topics.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 32

A	ABS	B	C	D	E	FX	NEABS
59,38	3,13	18,75	3,13	3,13	0,0	12,5	0,0

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-272/20	Slovak Language for Foreign Students (4)

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., 10.

Educational level: I., I.II., II., III.

Prerequisites:

Course requirements:
tests
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
This course is aimed for foreign students to better comprehend all the language skills important to enable correct usage of the Slovak language – listening comprehension, reading, writing and speaking.

Class syllabus:
The sylabus is targeted at the comprehension of all the language skills of the Slovak language , and it is a follow up course to the Slovak language course 3.

Recommended literature:
Krížom-Krážom Slovenčina 2, additional material to further support the covered topics.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 25

A	ABS	B	C	D	E	FX	NEABS
84,0	0,0	4,0	4,0	0,0	0,0	8,0	0,0

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KEF/2-FTL-954/22	**Course title:** Solid State Physics
Number of credits: 6	
Educational level: II.	
State exam syllabus:	
Last change: 09.02.2022	
Approved by: prof. Ing. Roman Martoňák, DrSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-115/17	Sports in Natur (1)

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

Number of credits: 2

Recommended semester: 1., 7.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Grades: A 90%, B 80%, C 70%, D 60%, E 50%
The condition for the award of 1 or 2 credits is the completion of a multi-day course in its full scope, or the completion of one-day courses in the scope of 4 days. Candidates can apply to the leaders of individual courses. From the presented offer of courses, you can choose the one that suits your interests, abilities and deadlines.

Learning outcomes:
Acquisition and development of basic motor skills and abilities in selected sports: skiing and snowboarding. Mastering the correct technique of performing individual movements, which are necessary for skiing and snowboarding.

Class syllabus:
The student can sign up for the outdoor sports courses offered by the department: skiing, snowboarding. The lessons in the courses are focused on the development of basic and special movement skills and mastering the techniques needed for the sports.

Recommended literature:

Languages necessary to complete the course:
Slovak

Notes:
KTVŠ does not rent ski equipment.

Past grade distribution
Total number of evaluated students: 185

A	B	C	D	E	FX
98,92	0,0	0,0	0,0	0,0	1,08

Lecturers: Mgr. Martin Dovičák, PhD., Mgr. Tomáš Kuchár, PhD., Mgr. Jana Leginusová, PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, PaedDr. Mikuláš Ortutay, Mgr. Júlia Raábová, PhD., Mgr. Tomáš Lovecký

Last change: 16.06.2022
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-116/18	Sports in Natur (2)

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

Number of credits: 2

Recommended semester: 2., 8.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Grades: A 90%, B 80%, C 70%, D 60%, E 50%.
The condition for the award of 1 or 2 credits is the completion of a multi-day course in its full scope, or the completion of one-day courses in the scope of 4 days. Candidates can apply to the leaders of individual courses. From the presented offer of courses, you can choose the one that suits your interests, abilities and deadlines.

Learning outcomes:
Creating a positive and lasting relationship with physical activity. Acquisition and mastery of basic motor skills and abilities in outdoor sports: windsurfing, beach volleyball, water tourism - river rafting, hiking and other sports according to interest. Training and improving the technique needed for the sports.

Class syllabus:
The student can sign up for the outdoor sports courses offered by the department: water tourism - river rafting, windsurfing, beach volleyball, hiking and other hobby sports. The lessons in the courses are focused on the development of basic and special movement skills and, mastering the techniques needed for the sports.

Recommended literature:

Languages necessary to complete the course:
Slovak

Notes:
KTVŠ will provide sports equipment.

Past grade distribution
Total number of evaluated students: 109

A	B	C	D	E	FX
95,41	0,0	0,0	0,0	0,0	4,59

Lecturers: Mgr. Martin Dovičák, PhD., Mgr. Tomáš Kuchár, PhD., Mgr. Jana Leginusová, PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, PaedDr. Mikuláš Ortutay, Mgr. Júlia Raábová, PhD., Mgr. Tomáš Lovecký
Last change: 16.06.2022
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-107/22	Structure and Mechanical Properties of Solids

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 4 / 2 **per level/semester:** 52 / 26
Form of the course: on-site learning

Number of credits: 8

Recommended semester: 1.

Educational level: II.

Prerequisites:

Recommended prerequisites:
knowledge of the basic concepts of solid state physics on the level of the course 2-FOL-117 Introduction to solid state physics

Course requirements:
Homework during semester
Written exam
Grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
The course provides deeper insight into the structure of a broad spectrum of forms of condensed matter, from ideal crystals to defective crystals to quasicrystals to liquid crystals to liquids and amorphous structures. Besides description of structure the course focuses on understanding of relations between structure, energy and entropy as well as phase transitions among structural phases.

Class syllabus:
Thermodynamic potentials and phase diagrams
Lattice vibrations in harmonic approximation - dynamical matrix, phonons
Anharmonic effects in crystals - thermal expansion
Quasicrystals and incommensurate structures
Defects in crystals - point defects, dislocations
Order/disorder transition in alloys
Structure of surfaces - reconstruction
Mechanical properties of solids - strain and stress tensors, elastic constants in crystals, plasticity, fracture
Structure of liquids, glasses and amorphous solids
Soft matter
Polymers and their properties
Liquid crystals, isotropic-nematic transition, Frederiks transition
2D systems - graphene

Recommended literature:

Solid state physics / Neil W. Ashcroft, N. David Mermin. Fort Worth : Harcourt Brace, 1976

Úvod do fyziky pevných látek / Charles Kittel ; přeložili Miloš Matyáš ... [et al.]. Praha : Academia, 1985

Condensed matter physics : Corrected printing / Michael P. Marder. New York : John Wiley, 2000

Languages necessary to complete the course:

Slovak, English

Notes:

Past grade distribution

Total number of evaluated students: 60

A	B	C	D	E	FX
60,0	11,67	10,0	10,0	8,33	0,0

Lecturers: prof. Ing. Roman Martoňák, DrSc.

Last change: 19.01.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FTL-127/23	Summer School of Condensed Matter Physics

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

Type, volume, methods and workload of the student - additional information
five-day event

Number of credits: 1

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
participation in lectures

Learning outcomes:
the student will gain an overview of modern problems in condensed matter physics

Class syllabus:
The summer school consists of 15 lectures by selected experts and presentations by doctoral students.

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: prof. Ing. Roman Martoňák, DrSc.

Last change: 15.06.2023

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/2-FFP-109/15	Vacuum Physics and Technology

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

Number of credits: 4

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Evaluation during semester: individual work
Approximate grade scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
The result of the training will be theoretical and practical knowledge about the methods of obtaining, maintaining and measuring low pressures in the range of 105 to 10-13 Pa, in the field of gas flow, as well as in the field of materials suitable for low pressure physics.
Students will gain knowledge enabling the design of vacuum equipment for scientific and technical equipment, select appropriate technical solutions (vacuum pumps, chambers, vacuum gauges).

Class syllabus:
Introduction to vacuum physics (historical overview, basic concepts, vacuum distribution, talc units). Kinetic theory of gases. Gas flow in viscous mode, mixed mode and molecular mode. Transmission phenomena in gases (diffusion, heat conduction). Processes taking place on the walls of vacuum systems (physical, chemical adsorption, absorption). Pumping process theory. Mechanical and dry pumps. Turbomolecular and diffusion pumps. Ionic and cryogenic pumps. Methods of measuring the pumping speed of the pump. Vacuum gauges. Measurement of partial pressures. Leak detection of vacuum systems. Selection of materials for vacuum technology. Design of vacuum apparatus.

Recommended literature:
Ch. Edelman, Vakuumphysik, Spektrum, Heidelberg, 1998

Languages necessary to complete the course:
english

Notes:

Past grade distribution Total number of evaluated students: 61					
A	B	C	D	E	FX
91,8	8,2	0,0	0,0	0,0	0,0
Lecturers: prof. Dr. Štefan Matejčík, DrSc., Mgr. Michal Stano, PhD.					
Last change: 31.01.2022					
Approved by: prof. Ing. Roman Martoňák, DrSc.					