Course descriptions

TABLE OF CONTENTS

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-419/15	Advanced Numerical Methods

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

Number of credits: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: homeworks, test
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will be able to properly select and use advanced numerical methods in solving mathematical and physical problems.

Class syllabus:
Approximations of derivatives and integrals, eigenvalues and eigenvectors of matrices, numerical solutions of differential equations, initial value problem, reduction to dimensionless form, uniqueness of solution, consistency, stability, solution convergence, Euler's method, Runge-Kutta method, multistep methods, predictor-corrector methods, higher order linear differential equations.

Recommended literature:
Numerical recipes in C++ : The Art of Scientific computing / William H. Press [et al.].
Cambridge : Cambridge University Press, 2002
Press, W. H., Flannery, B. P., Teukolsky, S. A., Vetterling, W. T.: Numerical Recipes in Fortran, The Art of Scientific Computing, Cambridge Universiy Press 1990.
Hämmerlin, G., Hoffmann, K. H.: Numerical Mathematics, Springer-Verlag, Berlin 1991.
Quarteroni, A., Sacco, R., Saleri, F.: Numerical Mathematics, Springer, Berlin 2000

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 4

A	B	C	D	E	FX
75,0	25,0	0,0	0,0	0,0	0,0

Lecturers: doc. Mgr. Jozef Kristek, DrSc.

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-420/15	Advanced Seismometry

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

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively.
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): 0/100

Learning outcomes:
gained more advanced knowledge of seismological applications

Class syllabus:
Seismic stations, networks, arrays, seismic monitoring, Geophysical observatories, seismic networks, array seismology, 3-component arrays, Practice at national network and CTBTO.

Recommended literature:
Earth Science / Edward J. Tarbuck, Frederick K. Lutgens. Columbus : Merill Publishing Company, 1988
Bormann, P. (ed.) (2012): New Manual of Seismological Observatory Practice (NMSOP-2), IASPEI, GFZ German Research Centre for Geosciences, Potsdam (ed.) 2012; http://nmsop.gfz-potsdam.de;
DOI: 10.2312/GFZ.NMSOP-2

Languages necessary to complete the course:
English

Notes:
The course is held in Vienna, Austria.

Past grade distribution
Total number of evaluated students: 5

A	B	C	D	E	FX
40,0	20,0	20,0	20,0	0,0	0,0

Lecturers: Dr. Yang Lu

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-422/15	Anisotropy

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

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Exam: written test, oral exam
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively.
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): 0/100

Learning outcomes:
gained insight into phenomena of seismic anisotropy, and their applications

Class syllabus:
Wave propagation in homogeneous anisotropic media, elastic anisotropy of minerals, polycrystalline rocks, Backus-, Reuss and other averages over anisotropic properties, transverse isotropy, effects at seismic wavelength, effects of seismic anisotropy on the different wave type: refraction, shear-wave splitting, surface waves (azimuthal anisotropy, radial anisotropy), anisotropy in the Earth, upper crust, lower crust, mantle, inner core, different tectonic environments, mountain chains, subduction zones, cracked media, Hudson-models, crack density, anisotropy effects in reflection seismic, applications in the hydrocarbon industry, relation with stress, reservoir engineering.

Recommended literature:
Interior structure of the earth and planets / Vladimir Naumovič Zharkov; translated from the Russian by William B. Hubbard and Ronald A. Masteler. Chur, Switzerland ; New York : Harwood Academic Publishers, 1986
Babuska, V., Cara, M.,: Seismic anisotropy in the Earth. Springer 1991.

Languages necessary to complete the course:
English

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 12

A	B	C	D	E	FX
41,67	41,67	8,33	0,0	8,33	0,0

Lecturers: Univ.-Prof. Dr. Götz Bokelmann

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, 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. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-123/15	Continuum Mechanics and Rheology

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:
Ongoing evaluation: homeworks, test
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will have a basic knowledge of deformation of macroscopic bodies and rheological models of real materials.

Class syllabus:
Continuum and level of macroscopic description. Elementary volume of the continuum.
Contact and non-contact forces.
Traction vector. Displacement vector, strain tensor.
Continuity of traction vector, stress state at a point, stress tensor, stress-tensor symmetry.
Equation of motion of continuum. Lagrange and Euler formalisms.
Constitutive relation of elastic continuum - Cauchy formulation.
Thermodynamics of deformation and strain energy function.
Betti's theorem. Green's elastodynamic function.
Crack and crack-generated deformation.
Elasticity, viscosity and plasticity.
Hooke's elastic body, Newton's viscous fluid, Saint-Venant plastic body.
Viscoelasticity and attenuation. Maxwell, Kelvin-Voigt and Zener models, and generalized Zener / Maxwell models.
Elastoplasticity and nonlinear stress-strain relationship. Iwan's model.

Recommended literature:

Pujol, J.: Elastic wave propagation and generation in seismology, Cambridge University Press, 2003
Ranalli, G.: Rheology of the Earth. Chapman & Hall 1995.
Moczo, P., Kristek, J., Gális, M.: The finite-difference modelling of earthquake motions, Waves and ruptures. Cambridge University Press 2014.

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 11

A	B	C	D	E	FX
18,18	9,09	0,0	9,09	36,36	27,27

Lecturers: prof. RNDr. Peter Moczo, DrSc.

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-102/15	Digital Filtering in Geophysics

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:

Course requirements:
Ongoing evaluation: homeworks, test, examples
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will have a basic knowledge of random signals and processes, digital signal filtering and the processing of continuous and discrete deterministic signals using continuous or discrete systems.

Class syllabus:
Discrete deterministic signals, discrete convolution and correlation.
Fourier transform of discrete signals. Discrete Fourier transform, fast Fourier transform, their basic properties, and spectra of basic types of discrete signals. Numerical realization of Fourier transform - decimation in time and decimation in frequencies.
Analog to digital conversion, digital to analog conversion. Signal sampling. Z-transformation and its properties.
Linear continuous systems. Impulse and frequency response functions, transient and impulse characteristics of the system. Block diagrams.
Linear discrete systems. Impulse and frequency response functions, transient and impulse characteristics of the system. Block diagrams.
Digital filters - recursive and non-recursive, principle of design, low-frequency, high-frequency and bandpass filters.
Correlation, optimization and polarization filters. Inverse filtration.

Recommended literature:

Tan, L., Jiang, J.: Digital Signal Processing: Fundamentals and Applications, (2nd Edition). Academic Press 2013.
Hayes M.: Schaums Outline of Digital Signal Processing, (2nd Edition). McGraw-Hill 2011.
Bath, M.: Spectral Analysis in Geophysics. Elsevier Scientific Publishing Company 1974.
Smith, S.W.: The Scientist’s and Engineer's Guide to Digital Signal Processing. California Technical Publishing 1999.

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 9

A	B	C	D	E	FX
55,56	22,22	11,11	0,0	11,11	0,0

Lecturers: doc. Mgr. Martin Gális, PhD.

Last change: 25.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-244/15	Electromagnetic Sounding

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: 3

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: homeworks, test, examples
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will have a basic knowledge of solving basic forward problems with stationary and time-varying electric and magnetic fields for determining the structures of electrical conductivity.

Class syllabus:
Vertical electrical sounding for two-layer and multilayer soil, apparent resistivity, Wenner electrode field, model of anisotropy of electrical conductivity, DC-method and models with inhomogeneous conductivity, model with exponential conductivity, perturbed electric fields for spherical and cylindrical inhomogeneity. Induced electrical polarization method.
Current loop over stratified soil, mutual impedance, measurement of resistivity using two coils, Hertz potentials, solution of Helmholtz equation.
Magnetotelluric sounding, impedance, Hertz vectors. Application in practice. Homogeneous side layers model, model with wavy interface. Magnetovariation sounding. Significance for understanding the structure of the Earth's mantle.

Recommended literature:
Wait, J. R.: Geo-Electromagnetism, Academic Press 1982.

Languages necessary to complete the course:
English

Notes:

Any number of students.

Past grade distribution
Total number of evaluated students: 4

A	B	C	D	E	FX
25,0	50,0	25,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Sebastián Ševčík, CSc.

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, 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.

Last change: 22.08.2021
Approved by: prof. RNDr. Peter Moczo, 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. RNDr. Peter Moczo, 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: 291

A	B	C	D	E	FX
75,26	9,62	4,81	1,37	1,03	7,9

Lecturers: Mgr. Aneta Barnes

Last change: 11.04.2024
Approved by: prof. RNDr. Peter Moczo, 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. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-423/15	Excursion

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

Number of credits: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Weight of the exam in the final evaluation: 0%.
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
Students get to know the professional context around their field of study.

Class syllabus:
Excursion to institutions, companies, field experiments in the domain of physics of the Earth, upon availability.

Recommended literature:
Earth Science / Edward J. Tarbuck, Frederick K. Lutgens. Columbus : Merill Publishing Company, 1988

Languages necessary to complete the course:
English

Notes:
Excursion is organized by University of Vienna. Any number of students.

Past grade distribution
Total number of evaluated students: 9

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

Lecturers: Univ.-Prof. Dr. Götz Bokelmann, assoc. prof. Dipl. geophys. Chi Zhang, Dr. Saikiran Tharimena

Last change: 28.01.2022
Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-425/15	Forensic Seismology

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

Number of credits: 2

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Exam: written test, oral exam
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 0/100

Learning outcomes:
Students get to know the application of seismology for forensic purposes.

Class syllabus:
Acoustic and seismological data as evidence for human activity, examples, detection thresholds of networks and arrays, seismic noise, advanced application of array techniques, nuclear verification, the Comprehensive Test Ban Treaty Organisation (CTBTO) in Vienna, IMS, IDC, OSI.

Recommended literature:
Elastic wave propagation and generation in seismology / Jose Pujol. Cambridge : Cambridge University Press, 2003
Koper, K. D., T. C. Wallace, S. R. Taylor, and H. E. Hartse, 2001, Forensic seismology and the sinking of the Kursk, EOS Trans., AGU, 82, pp. 37, 45-46.
Dahlman, O.: Detect and deter: can countries verify the nuclear test ban. Springer 2011.
Kristekova M., Moczo P., Labak P., Cipciar A., Fojtikova L., Madaras J., Kristek J. 2008. Time-Frequency Analysis of Explosions in the Ammunition Factory in Novaky, Slovakia. Bull. Seism. Soc. Am. 98, 2507–2516.

Languages necessary to complete the course:

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution Total number of evaluated students: 8					
A	B	C	D	E	FX
37,5	50,0	0,0	0,0	12,5	0,0
Lecturers: Univ.-Prof. Dr. Götz Bokelmann					
Last change: 26.01.2022					
Approved by: prof. RNDr. Peter Moczo, DrSc.					

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAMŠ/2-FFZa-243/15	Fractals and Chaos in Geophysics

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: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: test
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will have a basic knowledge of the theory of fractals and chaos in connection with geophysical and geological processes.

Class syllabus:
Syllabus:
Fractals and fractal dimension.
Examples of fractal statistics, fragmentation and its modelling.
Seismicity and tectonics, spatial distribution of earthquakes.
Yield and tonnage.
Geomorphology.
Fractal clustering.
Self-similar fractals.
Renormalization method.
Permeability and porosity.
Self-organized criticality.
Lorenz equations.

Recommended literature:
Turcotte, D.L.: Fractals and Chaos in Geology and Geophysics. Cambridge University Press 1997.

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 1

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

Lecturers: doc. RNDr. Peter Guba, PhD.

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, 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: 482

A	B	C	D	E	FX
48,76	19,09	17,01	8,09	2,07	4,98

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

Approved by: prof. RNDr. Peter Moczo, 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. RNDr. Peter Moczo, 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: 120

A	B	C	D	E	FX
45,83	25,83	18,33	5,83	0,83	3,33

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

Approved by: prof. RNDr. Peter Moczo, 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. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAMŠ/2-FFZa-203/15	Geodynamics

Educational activities:
Type of activities: course
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:
Ongoing evaluation: homeworks, test, examples, continuous evaluation of knowledge
Exam: written test, oral exam
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will have a basic knowledge of the physical nature of geodynamic and tectonic processes in the lithosphere and the Earth's mantle.

Class syllabus:
A brief history of plate tectonics.
A simple model of plate tectonics.
Lithosphere and Earth's mantle.
Two-dimensional flexure of a perfectly elastic thin plate.
Lithosphere flexure applications:
- under the weight of an island chain
- in the subduction region
- under the weight of mountains
Convection in a heated layer from below. Application to Earth’s mantle.
Current state of views on mantle convection and plate tectonics.

Recommended literature:
Geodynamics / Donald Lawson Turcotte, Gerald Schubert. Cambridge : Cambridge University Press, 2002
Bercovici, D.: Mantle Convection in Encyclopedia of Solid Earth Geophysics, Harsh Gupta (ed.). Springer 2011.

Languages necessary to complete the course:

English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 7

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

Lecturers: doc. RNDr. Ján Boďa, CSc.

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-426/15	Geology for Physicists

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:

Course requirements:
Weight of the exam in the final evaluation: 50%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 50/50

Learning outcomes:
Students get to know the basics of geology.

Class syllabus:
Minerals, rock types, magmatism, sedimentation, metamorphism, elements of petrology, principles of structural geology, stress and strain, faulting, ductile processes, folding, regional examples, geological evolution, geological time scale, orogenesis, erosion processes.

Recommended literature:
Physical geology / L. Don Leet, Sheldon Judson. Englewood Cliffs : Prentice-Hall, [1971]

Languages necessary to complete the course:
English

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 0

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

Lecturers: Univ.-Prof. Dr. Götz Bokelmann, Kurt Decker

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-421/15	Geophysical Measurements

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:
Exam: written test, oral exam
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 0/100

Learning outcomes:
Students get basic knowledge of instrumentation in earthquake seismology as well as in gravity and magnetic field observation.

Class syllabus:
Types of observations, absolute and relative gravity measurements, gravimeter (free fall gravimeter, LCR gravimeter, superconducting gravimeter), gravimeter calibration, magnetic instrumentation, gradiometer, satellite instrumentation, seismic sensors, inertial seismometer, frequency response, velocity transducer, accelerometers, velocity broadband sensors, force-feedback seismometer, self noise, new developments, micromachined accelerometers, parameters, instrument examples, seismic noise, analog-to-digital converters, Sigma-Delta ADAC, seismic recorders, instrument correction, seismic stations, calibration and testing.

Recommended literature:
Contributions of the Geophysical Institute of the Slovak academy of sciences / compiled by E. Závodská. Bratislava : Veda, 1991
Torge W.: Gravimetry. Walter de Gruyter 1989.
Havskov, J.: Instrumentation in Earthquake Seismology. Springer 2006.

Languages necessary to complete the course:
English

Notes:

The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 11

A	B	C	D	E	FX
9,09	27,27	9,09	27,27	9,09	18,18

Lecturers: Univ.-Prof. Dr. Götz Bokelmann, assoc. prof. Dipl. geophys. Chi Zhang, ao. Univ.-Prof. Dr. Bruno Meurers, Dr. Yang Lu

Last change: 28.01.2022

Approved by: prof. RNDr. Peter Moczo, 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: 828

A	B	C	D	E	FX
37,56	25,48	18,6	9,18	2,78	6,4

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

Last change: 21.06.2022

Approved by: prof. RNDr. Peter Moczo, 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: 541

A	B	C	D	E	FX
37,89	19,59	19,59	12,38	3,51	7,02

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

Last change: 21.06.2022

Approved by: prof. RNDr. Peter Moczo, 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: 184

A	B	C	D	E	FX
44,02	23,91	20,11	6,52	2,17	3,26

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

Last change: 21.06.2022

Approved by: prof. RNDr. Peter Moczo, 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: 21.06.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-427/15	Gravity Field

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:
Exam: written test, oral exam
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively.
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): 0/100

Learning outcomes:
Gained knowledge of basic aspects of the figure and the gravity of the Earth and of the dynamic processes of the Earth interior.

Class syllabus:
Figure of the earth, ellipsoid, geoid, gravitational and gravity potential, spherical harmonics expansion, normal ellipsoid and normal gravity, solution of Laplace's DGL in ellipsoidal coordinates, theorem of Clairaut, height systems, gravimetric geoid determination (boundary value problem in physical geodesy, integral formula of Stokes, boundary value problem of Molodensky), principles of satellite geodesy, global gravity models, 2-FFZoral gravity variations, earth tides, free oscillations and core modes, earth rotation, loading effects, isostasy and spatial variation of the gravity field, case histories.

Recommended literature:
Earth Science / Edward J. Tarbuck, Frederick K. Lutgens. Columbus : Merill Publishing Company, 1988
Torge, W.: Geodesy. Walter de Gruyter 2001.
Torge, W.: Gravimetry. Walter de Gruyter 1989.
Hofmann-Wellenhof, B., Moritz, H.: Physical Geodesy. Springer 2005.
Melchior, P.J. :The Tides of the Planet Earth. Pergamon Press 1978.

Languages necessary to complete the course:

English

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 9

A	B	C	D	E	FX
22,22	11,11	22,22	22,22	22,22	0,0

Lecturers: ao. Univ.-Prof. Dr. Bruno Meurers

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAMŠ/2-FFZa-152/15	Hydrodynamics

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: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: test, solving examples
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will be able to solve basic canonical problems of fluid dynamics.

Class syllabus:
Syllabus:
Surface waves on the surface of a deep fluid.
Wave dispersion and group velocity.
Surface tension and capillary wave effects. Surface waves on the surface of a shallow fluid.
Acoustic waves in a fluid. Internal gravitational waves.
Waves with a finite amplitude in a shallow fluid.
Viscous shock waves and solitary waves.
Kelvin-Helmholtz instability.
Thermal convection. Centrifugal instability.
Shear flow stability.
General theorem on viscous flow stability.
Unambiguity of steady viscous flow.

Recommended literature:
Elementary fluid dynamics / D. J. Acheson. Oxford : Clarendon Press, 1990
Batchelor, G. K., Moffatt, H. K., Worster, M. G.: Perspectives in Fluid Dynamics: A Collective Introduction to Current Research. Cambridge University Press 2002.

Languages necessary to complete the course:

English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 1

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

Lecturers: doc. RNDr. Peter Guba, PhD.

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-429/15	Induced Seismicity

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

Number of credits: 2

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Exam: written test, oral exam
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 0/100

Learning outcomes:
Gained basic knowledge regarding man-made changes in the topmost crust of the Earth and their possible effects.

Class syllabus:
Fundamentals of Rock Mechanics with special reference to geological fault zones, their properties and effects on the mine workings or dams, principles of rock mechanics in deep mining, assessment of seismic events in the mining industry, reservoir - induced seismicity, mining-induced seismicity. Exercises with direct application of contents of the lecture. Examples deal with e.g. how to estimate the size of earthquakes and stability questions.

Recommended literature:
Jak se studují zemětřesení : základy seismiky / Alois Zátopek. Praha : Jednota československých matematiků a fyziků, 1949
Fairhurst, C - editor (1990): Rockbursts and Seismicity in Mines. Balkema, ISBN 90-6191-145-1.
Gay, N C & Wainwright, E H - editors (1984): Rockbursts and Seismicity in Mines. Balkema, ISBN 0-620-06708X.
Jaeger, J C., Cook, N.G.W., (1969, Fundamentals of Rock Mechanics. Chapman & Hall, ISBN 0-412-22010-5,
Knoll, P - editor (1992): Induced Seismicity. Balkema.

Languages necessary to complete the course:
English

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 6

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

Lecturers: Univ.-Doz. Dr. Wolfgang Lenhardt

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, 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: 8

A	B	C	D	E	FX
75,0	0,0	0,0	0,0	25,0	0,0

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

Last change: 22.06.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-430/15	Inverse Problems

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:
Exam: written test, oral exam
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 0/100

Learning outcomes:
Students learn basic mathematical and numerical methods applied in solving inversion problems.

Class syllabus:
Elements of linear algebra and statistics, classification of inverse problems, linear regression, continuous inverse problem, discretization, Backus-Gilbert method, SVD, generalized inverse, covariance, resolution, ill-posed problems, Tikhonov regularisation, damped least-squares, iterative methods, conjugate gradient, maximum entropy, Gauss-Newton, Levenberg-Marquardt, Monte Carlo technique, hypothesis testing, travel time tomography, inversion for 1D Earth structure. If time, then: Adjoint techniques.

Recommended literature:
Time series analysis and inverse theory for geophysicists / David Gubbins. Cambridge : Cambridge University Press, 2004
Aster, R.C., Borchers, B., Thurber, C.H.: Parameter estimation and inverse problems. Elsevier 2005.
Tarantola, A., 2005, Inverse problem theory - and methods for model parameter estimation, SIAM, ISBN 978-0-89871-572-9

Languages necessary to complete the course:
English

Notes:

The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 12

A	B	C	D	E	FX
33,33	33,33	16,67	16,67	0,0	0,0

Lecturers: Univ.-Prof. Dr. Götz Bokelmann, Dr. Ekaterina Sherina

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-111/15	Magnetic Field of the Earth

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

Number of credits: 4

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: control questions, tests.
Exam: written test, oral exam.
Weight of the exam in the final evaluation: 80%.
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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:
After completing the course, students will have a basic knowledge of the properties of the Earth's magnetic field, its dynamic effects and their physical mechanisms.

Class syllabus:
Poisson and Laplace equations and their solutions.
Legendre polynomials.
Analytical expression of the Earth's magnetic field, spherical harmonic analysis.
Separation of the main (internal) and external fields.
International Geomagnetic Reference Field (IGRF). Earth's magnetic moment.
Geomagnetic field variations and processes in the ionosphere and magnetosphere.
Secular variations of the geomagnetic field.
Geomagnetic field reversals.
Electromagnetic induction in the Earth.
The electromagnetic response of the Earth and the electrical conductivity of the Earth's mantle.
Principles of geomagnetic field generation.
Ionospheric conductivity.

Recommended literature:
Campbell, Wallace H. Introduction to Geomagnetic Fields, Cambridge Univ. Press, 2003.
Parkinson, W.D.: Introduction to Geomagnetism, Elsevier, 1982

Languages necessary to complete the course:

English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 9

A	B	C	D	E	FX
22,22	11,11	55,56	0,0	11,11	0,0

Lecturers: doc. Mgr. Martin Gális, PhD., RNDr. Adriena Ondrášková, PhD.

Last change: 28.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-140/15	Magnetohydrodynamics

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: 3

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: test
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will have a basic knowledge of the equations of cosmic magnetohydrodynamics (MHD), the physical principles of the generation of the Earth's magnetic field and the mechanisms of its secular variations.

Class syllabus:
Basic equations of cosmic MHD, dimensional analysis, induction equation, Reynolds magnetic number. Lorentz body force. Navier-Stokes equation, Boussinesq approximation. Equation of magnetostrophic equilibrium and its solution. Geostrophic flow. Taylor-Proudman theorem. Magnetic field drift, extraction and diffusion. Alfvén's theorem. Structural properties of magnetic field, magnetic helicity. Toroidal and poloidal magnetic and velocity fields, their mutual interaction. Consequences of selected field symmetries on generation mechanisms. Kinematic dynamo. Antidynamic theorems. Cowling's theorem. Braginsky's almost axially symmetric dynamo. Generation mechanisms, alpha-effect, omega-effect.
Hydromagnetic waves, Alfvén waves, inertial waves, MC and MAC waves. Hydromagnetic instabilities (ideal, gradient, resistive). Complete dynamo theory, models of self-consistent self-exciting dynamos. Computer simulations.

Recommended literature:
Moffat, H. K.: Magnetic field generation in electrically conducting fluid. Cambridge University Press 1978.

Languages necessary to complete the course:

English

Notes:
Any number of students

Past grade distribution
Total number of evaluated students: 1

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

Lecturers: doc. RNDr. Sebastián Ševčík, CSc., Mgr. Miloš Revallo, PhD.

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-922/15	Master Seminar

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

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: presentation of partial results of master thesis, study of the current scientific articles and literature, preparing reports
Exam: written test, oral exam
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will be able to acquire knowledge by studying selected journals and books needed to prepare a thesis.

Class syllabus:
Presentation of the current progress towards achieving the goals of master theses. Each student presents at least twice his / her results or the results of fundamentally relevant publications from the scientific articles that relate to his / her master thesis.
The specific content of the seminar adapts to the nature of the master theses.

Recommended literature:

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution Total number of evaluated students: 10					
A	B	C	D	E	FX
80,0	10,0	10,0	0,0	0,0	0,0
Lecturers: prof. RNDr. Peter Moczo, DrSc., Univ.-Prof. Dr. Götz Bokelmann					
Last change: 26.01.2022					
Approved by: prof. RNDr. Peter Moczo, DrSc.					

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-913/15	Master Thesis

Educational activities:
Type of activities: independent work
Number of hours:
per week: 28 **per level/semester:** 364
Form of the course: on-site learning

Number of credits: 28

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Weight of the exam in the final evaluation: 0%.
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
The result of the course will be a finished master thesis.

Class syllabus:
Study of book and journal literature, research work, formulation of goals of the master thesis, its structure, proposal of problem solution. Reporting on the progress of solving the assigned topic, discussion of unexpected problems. Formulation of the concept of the master thesis. Intensive work, logical arrangement of results, their processing and evaluation. Evaluation of the fulfillment of objectives and formulation of conclusions. Comparison with the results of other authors in the journal literature and assessment of the own contribution. Preparation of an outline of the content of the thesis and a manuscript of the thesis. Preparation of figures, graphs and tables, and overall visualization of results. Text editing, final editing, linguistic and stylistic text control. Preparation of the presentation of the results of the thesis for the defense, preparation of responses to reviewers' comments.

Recommended literature:

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution Total number of evaluated students: 10					
A	B	C	D	E	FX
80,0	0,0	10,0	0,0	10,0	0,0
Lecturers: prof. RNDr. Peter Moczo, DrSc., Univ.-Prof. Dr. Götz Bokelmann					
Last change: 28.01.2022					
Approved by: prof. RNDr. Peter Moczo, DrSc.					

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-432/15	Mineral Physics and Mineral Transformations

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: 5

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Exam: written test, oral exam
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 0/100

Learning outcomes:
Have learned basics of mineral physics and mineral transformations.

Class syllabus:
Mineral physics, structural variations, stability criteria, transformation of solids under changing physical conditions, mineral phase transformations, relation between properties of solids and atomic mechanisms, mineral phases relevant for the Earth`s interior, geophysical properties and their relation with thermomechanical and transport properties, tensorial decryption of properties, anisotropy.

Recommended literature:
Physical geology / L. Don Leet, Sheldon Judson. Englewood Cliffs : Prentice-Hall, [1971]

Languages necessary to complete the course:
English

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 0

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

Lecturers: Univ.-Prof. Dr. Ronald Miletich-Pawliczek
Last change: 26.01.2022
Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-440/15	Nuclear Geophysics

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: 3

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: homeworks, test.
Weight of the exam in the final evaluation: 0%.
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will have basic knowledge of the methods and applications of nuclear geophysics in the exploration of the Earth and in the search for minerals.

Class syllabus:
Fundamentals of nuclear geophysics.
What and how we measure in nuclear geophysics.
Basic interpretation models.
Geophysical tracers.
Solving inverse problems of nuclear geophysics.
Applications of nuclear geophysics in the field of uranium mining, oil, industrial processes, construction, and environmental studies.
Future trends.

Recommended literature:
Nuclear geophysics and its applications, IAES Technical reports series No. 574 (2012).
Clayton, C. G.: Nuclear geophysics. Elsevier 2003.
Ferronsky, V. I.: Nuclear geophysics. Springer 2015.

Languages necessary to complete the course:
English

Notes:

Any number of students.

Past grade distribution
Total number of evaluated students: 4

A	B	C	D	E	FX
75,0	25,0	0,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Jozef Masarik, DrSc.

Last change: 28.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-108/15	Numerical Methods

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

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: homeworks, test, examples
Exam: written test, oral exam
Weight of the exam in the final evaluation: 80%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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:
After completing the course, students will be able to properly choose and use basic numerical methods in solving mathematical and physical problems.

Class syllabus:
Errors and their propagation, representation of numbers and accuracy, algorithms and convergence. Solution of nonlinear equations g (x) = 0, root separation, bisection method, regula falsi, Newton's method and fixed-point method. Numerical methods for solving systems of equations, finding the determinant and inverse matrix, LU-matrix decomposition, singular value decomposition, Jordan's form, Jacobi and Gauss-Jacobi methods, Cholesky algorithm, iterative methods, fastest gradient method. Gradient methods for solving linear systems. Interpolation and approximation, Lagrange, Newton and Chebyshev interpolation polynomial, least squares method. Cubic spline interpolation.

Recommended literature:
Numerical recipes in C++ : The Art of Scientific computing / William H. Press [et al.]. Cambridge : Cambridge University Press, 2002
Press, W. H., Flannery, B. P., Teukolsky, S. A., Vetterling, W. T.: Numerical Recipes in Fortran, The Art of Scientific Computing. Cambridge Universiy Press 1990.
Hämmerlin, G., Hoffmann, K. H.: Numerical Mathematics. Springer-Verlag, Berlin 1991.
Quarteroni, A., Sacco, R., Saleri, F.: Numerical Mathematics. Springer, Berlin 2000.

Languages necessary to complete the course:

English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 12

A	B	C	D	E	FX
41,67	25,0	8,33	8,33	0,0	16,67

Lecturers: doc. Mgr. Jozef Kristek, DrSc.

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-424/15	Numerical Modeling of Seismic Wavefields

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: 3

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: homeworks, test, examples
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will be able to work on the development of methods for numerical modelling of seismic wave propagation and seismic motion.

Class syllabus:
Introduction: seismic processes in the Earth, and Earth models.
Basic mathematical-physical model: forms of equation of motion, constitutive relations, strong formulations of equation of motion, boundary conditions, initial conditions, wave field sources.
Overview and comparison of numerical methods: finite-difference method, finite- and spectral-element methods, discontinuous Galerkin method.
Finite-difference method: time-space grids, approximations of derivatives, explicit and implicit schemes, properties of schemes.
Finite-difference method for 1D problem: harmonic plane wave in a grid, grid dispersion, schemes for unbounded heterogeneous medium, schemes for material interface, schemes for free surface, grid boundaries, wave field excitation, inclusion of attenuation.

Recommended literature:
The finite-difference method for seismologists : An introduction / Peter Moczo [et al.].
Bratislava : Comenius University, 2004
Moczo, P., Kristek, J., Gális, M.: The finite-difference modelling of earthquake motions, Waves and ruptures. Cambridge University Press 2014.
Fichtner, A.: Full Seismic Waveform Modelling and Inversion. Springer 2010.

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 3

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

Lecturers: prof. RNDr. Peter Moczo, DrSc., doc. Mgr. Martin Gális, PhD.

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-433/15	Paleomagnetism

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: 3.

Educational level: II.

Prerequisites:

Course requirements:
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 0/100

Learning outcomes:
Students get to know the basics of paleomagnetism, and its applications in Earth sciences.

Class syllabus:
Fundamentals of geomagnetism, ferro(i)magnetic minerals (types, minerals, oxidations states, identification, curie 2-FFZeratures, hysteresis, experiments), remanent magnetizations and the history of the magnetic field (natural remanent magnetizations, identification, viscous components, principle component analysis, fisher statistics), sampling, measurements and data analysis, determining the past field strength (e.g. paleointensity techniques), applications and scientific fields: paleomagnetism and the reconstruction of global plate tectonics, magnetostratigraphy and dating, geomagnetic field reversals, archeomagnetism, biomagnetism.

Recommended literature:
Earth Science / Edward J. Tarbuck, Frederick K. Lutgens. Columbus : Merill Publishing Company, 1988
Paleomagnetism: Magnetic Domains to Geologic Terranes. By Robert F. Butler. Originally published by. Blackwell Scientific Publications, 1992.

Languages necessary to complete the course:
English

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 6

A	B	C	D	E	FX
33,33	50,0	16,67	0,0	0,0	0,0

Lecturers: Dr. Roman Leonhardt

Last change: 26.01.2022

Approved by: prof. RNDr. Peter Moczo, 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: 201

A	B	C	D	E	FX
89,55	1,49	1,49	0,0	2,99	4,48

Lecturers: Mgr. Xenia Daniela Poslon, PhD.

Last change: 06.09.2023

Approved by: prof. RNDr. Peter Moczo, 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: 201

A	B	C	D	E	FX
89,55	1,49	1,49	0,0	2,99	4,48

Lecturers: Mgr. Xenia Daniela Poslon, PhD.

Last change: 06.09.2023

Approved by: prof. RNDr. Peter Moczo, 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: 1911

A	B	C	D	E	FX
97,65	0,63	0,05	0,0	0,0	1,67

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

Last change: 15.03.2022

Approved by: prof. RNDr. Peter Moczo, 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

Last change: 15.03.2022

Approved by: prof. RNDr. Peter Moczo, 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: 1454

A	B	C	D	E	FX
98,56	0,41	0,07	0,0	0,07	0,89

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

Last change: 15.03.2022

Approved by: prof. RNDr. Peter Moczo, 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

Last change: 15.03.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-202/15	Physics of Ionosphere and Magnetosphere

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

Number of credits: 6

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: control questions, test
Exam: oral exam
Weight of the exam in the final evaluation: 80%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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:
After completing the course, students will have a basic knowledge of the theory of formation of the ionized layer around the Earth, the ionosphere and magnetosphere, and the physics of the Solar-terrestrial relations.

Class syllabus:
Radiation affecting the atmosphere and its changes. Neutral atmosphere, hydrostatic equilibrium, pressure and concentration distributions. Interaction of radiation with the atmosphere. Heat balance equation, heat absorption and transport. Atmospheric temperature. Diffusion. Photochemical and drift equilibrium. Chapman's theory of the ionized layer in the atmosphere. Propagation of electromagnetic waves, ionosphere sounding. Electron concentration distribution with height, seasonal variations.
Recombination processes. Properties of individual ionospheric layers, main maximum. D-layer and PCA and SID perturbations. Plasmasphere.
Motion of charged particles in electric and magnetic fields. Drift motion, adiabatic invariants. Ring current and magnetic field disturbances on the Earth's surface. Radiation belts.
The magnetic field of the Sun and Parker's solar wind theory. Interaction of the solar wind with the geomagnetic field. Open and closed magnetosphere.
Formation of the boundary between the solar wind plasma and the geomagnetic field, and changes due to fluctuations in the solar wind. Current systems in the polar regions. Processes

in the magnetosphere. Magnetic reconnections, magnetohydrodynamics equations, current layers, applications in the magnetosphere. Auroras, magnetic storms. Shock waves in the solar system. Basic information about the cavity resonator between the Earth and the ionosphere.

Recommended literature:

Ratcliffe, J.A.: Introduction to the ionosphere and magnetosphere. Cambridge University Press 1972.
Prolls, G.W.: Physics of the Earth's Space Environment. Springer 2004.

Languages necessary to complete the course:

English

Notes:

Any number of students.

Past grade distribution

Total number of evaluated students: 11

A	B	C	D	E	FX
54,55	18,18	18,18	0,0	9,09	0,0

Lecturers: RNDr. Adriena Ondrášková, PhD., Mgr. Dávid Gregor, PhD., doc. Mgr. Martin Gális, PhD.

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-439/15	Physics of the Earth Seminar (1)

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

Number of credits: 2

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: homeworks, presentation.
Exam: written test, oral exam.
Weight of the exam in the final evaluation: 0%.
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will be able to critically and analytically read scientific articles in journal literature and present the acquired knowledge.

Class syllabus:
Presentations by students and teachers on the most current issues of research of the structure of the Earth and the processes inside and around the Earth, based on publications in scietific journals. Emphasis on publications with a tutorial and a more comprehensive integrated view of physical processes in planetary bodies and near space.

Recommended literature:

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 13

A	B	C	D	E	FX
61,54	23,08	7,69	0,0	0,0	7,69

Lecturers: prof. RNDr. Peter Moczo, DrSc.
Last change: 27.01.2022
Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-434/15	Physics of the Earth Seminar (2)

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

Number of credits: 2

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Weight of the exam in the final evaluation: 0%.
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
Have learned how to present scientific material in front of an audience, and to critically examine the material; have come to use presentation tools.

Class syllabus:
Presentation of scientific material, e.g., published papers, before the class. Discussion of the material by the presenting student and the entire student body.

Recommended literature:

Languages necessary to complete the course:
English

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 12

A	B	C	D	E	FX
66,67	33,33	0,0	0,0	0,0	0,0

Lecturers: Univ.-Prof. Dr. Götz Bokelmann, assoc. prof. Dipl. geophys. Chi Zhang, Dr. Yang Lu

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-428/15	Physics of the Earth's Material

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: 3

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: homeworks, test
Exam: written test, oral exam
Weight of the exam in the final evaluation: 80%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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:
After completing the course, students will have basic knowledge of the microphysical aspects of materials in extreme conditions inside the Earth.

Class syllabus:
Fundamentals of solid phase thermodynamics, isothermal and adiabatic bulk moduli, seismic parameter, elastic moduli of crystal aggregates. Thermoelasticity, thermodynamic Grüneisen parameter. Density in the Earth’s mantle as a function of depth, Adams-Williamson equation, Bullen’s parameter.
Thermal oscillations of the crystal lattice, dispersion curve for infinite and finite lattice, principles of Debye solid state theory, long-wave approximation, Debye frequency, Grüneisen parameters, Slater gamma.
Isothermal equations of state, Murnaghan integral equation of state, Birch-Murnaghan equation of state, equations of state determined from interatomic potentials. Birch's laws. Phase transitions, phase diagrams of binary systems, melting curves, polymorphism and transition region in the mantle. Basic mantle rock-forming minerals and their phase transitions. Melting, Simon and Kraut-Kennedy equation. Processes in the liquid core of the Earth, solidification. Transport processes, solid state diffusion, vacancies and dislocations, viscosity, diffusion and dislocation creeps. Convection in the mantle.

Recommended literature:

Poirier, J.-P.: Introduction to the Physics of the Earth's Interior. Cambridge University Press 2000.

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 0

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

Lecturers: doc. RNDr. Sebastián Ševčík, CSc.

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-435/15	Potential Field Methods

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:

Course requirements:
Exam: written test, oral exam
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 0/100

Learning outcomes:
Students get deeper knowledge of potential theory applications.

Class syllabus:
Potential theory and its application in geophysics, source distribution (Newtonian potential, 1/r-function, convolution theorem, Delta-distribution, special source geometries, arbitrary sources, dipole, dipole distribution, Poisson-theorem, multi-pole distribution, magnetic induction), Green's function, Green's theorem, Boundary value problem and field continuation, field transformation in Cartesian and polar coordinate system (filtering, convolution), equivalent sources, Continuity property at discontinuities, 2D potential fields (logarithmic potential, analytical signal, generalized AS), Euler- and Werner deconvolution.

Recommended literature:
Blakely, R.J.: Potential Theory in Applied Gravity and Magnetic Applications. Cambridge University Press 1995.

Languages necessary to complete the course:
English

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 5

A	B	C	D	E	FX
20,0	20,0	0,0	0,0	60,0	0,0

Lecturers: ao. Univ.-Prof. Dr. Bruno Meurers

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI-PriF.KIHG/2-FFZa-431/15	Regional Structure (1)

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

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: homeworks, test
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will have a basic knowledge of the regional structures of the Carpathian-Pannonian region.

Class syllabus:
Geophysical methods and their applicability in the research of regional structure.
Characteristics of basic physical properties of lithosphere rocks.
Isostasis - local and regional.
Conversion of seismic wave velocity to densities.
Geophysical research of the regional structure of the Western Carpathians.
Seismic research of the structure of the Carpathian-Pannonian region and its surroundings.
Gravimetric research of the structure of the Carpathian-Pannonian region and its surroundings.
Magnetometric research of the structure of the Carpathian-Pannonian region and its surroundings.
Magnetotelluric research of the structure of the Carpathian-Pannonian region and its surroundings.
Geothermal research of the structure of the Carpathian-Pannonian region and its surroundings.
Integrated geophysical modelling of regional structure.
Creation of an integrated model of regional structure.

Recommended literature:
Lillie, J. R.: Whole Earth Geophysics. Prentice Hall, Upper Saddle River, New Jersey 1999.
Percival, J. A., Cook, F. A., Clowes, R. M.: Tectonic styles in Canada: The lithoprobe perspective. Geological Assosiation of Canada 2012.

Bielik, M., Šefara, J.: Deep structure of the Western Carpathians. Krystalinikum, Moravské zemské muzeum 2002.
Vozár, J., Ebner, F., Vozárová, A., Haas, J., Kovács, S., Sudar, M., Bielik, M., Csaba, P.: Variscan and Alpine terranes of the Circum-Pannonian Region. Bratislava, Slovak Academy of Sciences 2010.

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 9

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

Lecturers: prof. RNDr. Miroslav Bielik, DrSc.

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-441/15	Regional Structure (2)

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

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Exam: written test, oral exam
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 0/100

Learning outcomes:
Student gets to know research approaches for better understanding the Earth`s interior and dynamics, using the Eastern Alpine region as an example.

Class syllabus:
Some elements of plate tectonics, regional geodynamics, block tectonics, Alpine evolution, Pannonian basin, Carpathians, new seismological results from seismic anisotropy, receiver functions and dispersion, constraints from paleomagnetics (block rotations), lateral escape and its potential manifestation in mantle deformation, tectonic faults in the Eastern Alps and towards the Pannonian basin, seismicity in the Eastern Alps, results from geodesy, constraints from potential field data.

Recommended literature:
Earth Science / Edward J. Tarbuck, Frederick K. Lutgens. Columbus : Merill Publishing Company, 1988
Bokelmann, G., Qorbani Chegeni, E., Bianchi, I., 2013, Seismic Anisotropy and Large-Scale Deformation of the Eastern Alps, Earth and Planetary Science Letters, doi:10.1016/j.epsl.2013.09.019.

Languages necessary to complete the course:
English

Notes:

The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 6

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

Lecturers: Univ.-Prof. Dr. Götz Bokelmann

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, 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: 738

A	B	C	D	E	FX
57,86	16,53	10,98	4,2	1,76	8,67

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

Approved by: prof. RNDr. Peter Moczo, 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. RNDr. Peter Moczo, 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: 212

A	B	C	D	E	FX
69,34	17,92	8,96	2,36	0,0	1,42

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

Approved by: prof. RNDr. Peter Moczo, 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. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-436/15	Seismic Exploration

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

Number of credits: 3

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Weight of the exam in the final evaluation: 50%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 50/50

Learning outcomes:
Students get to know the basics of seismic exploration methods, especially of reflection seismology.

Class syllabus:
Brief review of seismic theory, partitioning of energy at an interface, Zoeppritz equations, head waves, seismic velocity, density, porosity, Gassmann and Biot equation,
resolution, Fresnel zones, seismic equipment, reflection methods, CMP method, data processing methods, Radon-transform, convolution, stacking, migration, geological interpreation, refraction method, 3D seismics, tomography, VSP, borehole tomography, 4D seismics.

Recommended literature:
Sheriff, R.E., Geldart, L.P.: Seismic exploration. Cambridge University Press 2006.

Languages necessary to complete the course:
English

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 8

A	B	C	D	E	FX
37,5	25,0	25,0	0,0	12,5	0,0

Lecturers: Dr. Yang Lu, MSc. Richard Kramer

Last change: 27.01.2022
Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-241/15	Seismic Hazard

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: 3

Recommended semester: 2.

Educational level: II.

Prerequisites: FMFI.KAFZM/2-FFZa-105/15 - Statistical Methods of Data Analysis

Course requirements:
Ongoing evaluation: homeworks, test.
Exam: written test, oral exam.
Weight of the exam in the final evaluation: 80%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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:
After completing the course, students will have a basic knowledge of the physical assumptions and methods of seismic hazard analysis.

Class syllabus:
Introduction, terminology.
Elements of statistics and probability.
Deterministic and probabilistic analyses of seismic hazard. Uncertainties.
Integral of seismic hazard. Disaggregation.
Distribution functions for distance and magnitude.
Ground motion prediction equations.
Simple examples of analysis.
Logic tree. Site effects. Selection of accelerograms.
Case studies.
Practical aspects, open questions, alternative approaches.

Recommended literature:
Reiter, L.: Earthquake hazard analysis. Issues and insights. Columbia University Press, New York 1990.
Kramer, S. L.: Geotechnical Earthquake Engineering. Prentice Hall, New Jersey 1996.

McGuire, R. K.: Seismic Hazard and Risk Analysis. Earthquake Engineering Research Institute, Oakland 2004.
Baker, J. W.: An Introduction to Probabilistic Seismic Hazard Analysis (PSHA). Version 1.3. 2008 (http://web.stanford.edu/~bakerjw/Publications/).

Languages necessary to complete the course:
English

Notes:
Prerequisite course. Any number of students.

Past grade distribution
Total number of evaluated students: 11

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

Lecturers: doc. Mgr. Jozef Kristek, DrSc., RNDr. Róbert Kysel, PhD.

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-110/15	Seismic Waves and Physics of Earthquakes (1)

Educational activities:
Type of activities: course
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:
Ongoing evaluation: test, solving examples
Exam: written test, oral exam
Weight of the exam in the final evaluation: 80%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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:
After completing the course, students will have a basic knowledge of the physics of seismic waves and analytical solutions of basic canonical problems.

Class syllabus:
Equation of motion: in time and frequency domain, 3D, 2D SH, 2D PSV, 1D, isotropic and anisotropic continuum, elastic and viscoelastic continuum.
Overview of methods for solving the equation of motion.
Elastic waves in an unbounded homogeneous elastic continuum: Helmholtz decomposition, P and S waves, plane and spherical waves.
Reflection of plane waves at a flat free surface. Reflection and refraction of plane waves at the plane interface.
Surface waves in homogeneous and layered half-space, geometric dispersion. 1D vertical resonance in a layered half-space.
Diffraction. Waves in the anisotropic continuum.
Attenuation. High frequency waves. Ray method.

Recommended literature:
Elastic wave propagation and generation in seismology / Jose Pujol. Cambridge : Cambridge University Press, 2003
Shearer, P. M.: Introduction to seismology. Cambridge University Press 2009.
Gubbins, D.: Seismology and plate tectonics. Cambridge University Press 1990.

Aki, K., Richards, P. G.: Quantitative seismology. University Science Books 2002.
Kanamori, H. (ed.): Earthquake Seismology. Elsevier 2009.
Romanowicz, B., Dziewonski, A. (eds.): Seismology and Structure of the Earth. Elsevier 2009.

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 12

A	B	C	D	E	FX
16,67	8,33	8,33	16,67	16,67	33,33

Lecturers: prof. RNDr. Peter Moczo, DrSc.

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-210/15	Seismic Waves and Physics of Earthquakes (2)

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

Number of credits: 4

Recommended semester: 2.

Educational level: II.

Prerequisites: FMFI.KAFZM/2-FFZa-110/15 - Seismic Waves and Physics of Earthquakes (1)

Course requirements:
Ongoing evaluation: test, solving examples
Exam: written test, oral exam
Weight of the exam in the final evaluation: 80%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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:
After completing the course, students will have basic knowledge of the propagation of seismic waves in heterogeneous media, approximate methods of solving the equation of motion, and seismic waves in the Earth.

Class syllabus:
Seismic waves in the Earth.
Representation theorem for the inner surface. Body-force equivalent of displacement dislocation. Moment-density tensor. Efficient point source. Moment tensor. Scalar seismic moment. Wave field generated by a point force in a homogeneous continuum. Wave field generated by a point DC source. Radiation characteristics.
Kinematic and dynamic model of a seismic source. Slip, slip rate, stress on a fault, boundary conditions for dynamic rupture propagation, friction laws. Modes of rupture propagation. Sub-Rayleigh and supershear rupture propagation.
Directivity, source spectrum, stress drop, self-similarity and scaling laws.
Seismic energy. Earthquake magnitude, earthquake effects.

Recommended literature:
Elastic wave propagation and generation in seismology / Jose Pujol. Cambridge : Cambridge University Press, 2003
Shearer, P. M.: Introduction to seismology. Cambridge University Press 2009.

Gubbins, D.: Seismology and plate tectonics. Cambridge University Press 1990.
Aki, K., Richards, P. G.: Quantitative seismology. University Science Books 2002.
Kanamori, H. (ed.): Earthquake Seismology. Elsevier 2009.
Romanowicz, B., Dziewonski, A. (eds.): Seismology and Structure of the Earth. Elsevier 2009.
Moczo, P., Kristek, J., Gális, M.: The finite-difference modelling of earthquake motions, Waves and ruptures. Cambridge University Press 2014.

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 11

A	B	C	D	E	FX
45,45	18,18	0,0	18,18	18,18	0,0

Lecturers: prof. RNDr. Peter Moczo, DrSc.

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-131/15	Signal Analysis

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:
Ongoing evaluation: homeworks, test, examples
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will have a basic knowledge of types of time signals, basic methods of their analysis, convolution and correlation and discretization of signals.

Class syllabus:
Basic characteristics and properties of signal.
Fourier series of periodic signals. Fourier series of non-periodic signals. Convergence of Fourier series. Fourier transform of non-periodic signals, its basic properties. Fourier transform of real functions. Important examples of Fourier transform.
Convolution, properties of convolution and its graphical representation, convolution theorem. Spectra of important functions, different types of spectra. Spectra of non-periodic functions. Correlation and autocorrelation, the relationship between correlation and convolution. Autocorrelation and Rayleigh theorem.
Hilbert transform and its properties, spectrum of Hilbert transform. Analytical signal, envelope and instantaneous frequency. Spectra of causal functions.
Signal sampling, sampling theorem. Sampling of wideband and narrowband signals, practical notes on sampling of real signals. Discrete Fourier transform and its basic properties, the relationship between Fourier transform and discrete Fourier transform, choice of parameters in practical calculations.

Recommended literature:
Moczo, P.: Signal Analysis – Lecture Notes. www.fyzikazeme.sk/mainpage 2001.

Lyons, L. G.: Understanding Digital Signal Processing. Prentice Hall, New Jersey 2004.
Gubbins, D.: Time Series Analysis and Inverse Theory for Geophysicists. Cambridge University Press 2004.
Arfken, G. B. and Weber, H. J.: Mathematical Methods for Physicists. Fourth Edition. Academic Press 1995.

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 12

A	B	C	D	E	FX
41,67	0,0	58,33	0,0	0,0	0,0

Lecturers: prof. RNDr. Peter Moczo, DrSc., Mgr. Miriam Kristeková, PhD.

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, 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: 113

A	ABS	B	C	D	E	FX	NEABS
32,74	23,89	8,85	6,19	0,88	0,0	24,78	2,65

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

Approved by: prof. RNDr. Peter Moczo, 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: 86

A	ABS	B	C	D	E	FX	NEABS
62,79	18,6	1,16	1,16	0,0	0,0	9,3	6,98

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

Approved by: prof. RNDr. Peter Moczo, 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. RNDr. Peter Moczo, 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. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-442/17	Special Functions in Geophysics

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: 3

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: homeworks, test.
Weight of the exam in the final evaluation: 0%.
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will be able to use special mathematical functions in solving geophysical problems.

Class syllabus:
Second-order partial differential equations, solution of partial differential equations by the method of separation of variables, linear independence of solutions, Frobenius method
Sturm-Liouville equation, self-adjoint operators, eigenvalues and eigenfunctions, Hermitian operators and their properties, Green's functions, Gram-Schmidt orthogonalization, orthogonal polynomials.
Legendre functions, Legendre polynomials and their properties, associated Legendre functions, associated Legendre polynomials and their properties, spherical harmonic functions,
Chebyshev functions, Chebyshev polynomials and their properties, Laguerre functions, Laguerre polynomials and their properties, Hermitian functions, Hermitian polynomials and their properties.
Bessel differential equation, Bessel functions of the 1st kind and their properties, Bessel functions of the 2nd kind and their properties.

Recommended literature:
Arken, G., Weber, H.: Mathematical Methods for Physicists. Elsevier Academic Press, 2005.
Riley, K., Hobson, M., Bence, S.: Mathematical Methods for Physics and Engineering. Cambridge University Press, 2006.

Languages necessary to complete the course:

English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 4

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

Lecturers: doc. RNDr. Sebastián Ševčík, CSc., RNDr. Róbert Kysel, PhD.

Last change: 28.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-231/15	Special Topics in Signal Analysis

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: 3

Recommended semester: 2.

Educational level: II.

Prerequisites: FMFI.KAFZM/2-FFZa-131/15 - Signal Analysis

Course requirements:
Ongoing evaluation: homeworks, test, examples.
Weight of the exam in the final evaluation: 0%.
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will have a basic knowledge of methods of the time-frequency analysis of signals and methods of quantitative comparison of signals.

Class syllabus:
Stationary and non-stationary signals, time, frequency and time-frequency signal analyses, atomic decompositions and energy distributions. Instantaneous frequency and group delay, Heisenberg-Gabor uncertainty principle.
Windowed Fourier transform method, spectrogram. Examples of applications. Continuous wavelet transform, scalogram. Discrete wavelet transform, wavelet packets. Examples of applications. Wigner - Ville distribution. Cross-members. Cohen class and affine Cohen class of transformations. Relationship of Wigner-Ville distribution with other energy distributions.
Reassignment method, principle and relations for reassignment of spectrogram and scalogram. Matching pursuit decomposition, original version, linear and quadratic versions. Examples of applications. EMD (Empirical mode decomposition) / HHT (Hilbert-Huang transform) method. Examples of applications.

Recommended literature:
Carmona, R., Hwang, W.-L., Torrésani, B.: Practical Time-Frequency Analysis. Academic Press 1998.
Daubechies, I.: Ten lectures on wavelets. SIAM 1992.
Flandrin, P.: Time-frequency / time-scale analysis. Academic Press 1999.

Huang, N. E., Shen, Z., Long, S. R., Wu, M. C. , Shih, H. H., Zheng, Q., Yen, N.-C., Tung, C. C., Liu, H. H.: The empirical mode decomposition and the Hilbert spectrum for nonlinear and non-stationary time series analysis. Proc. R. Soc. London, Ser. A, 454, 903–995, 1998.

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 8

A	B	C	D	E	FX
62,5	0,0	25,0	0,0	12,5	0,0

Lecturers: prof. RNDr. Peter Moczo, DrSc., Mgr. Miriam Kristeková, PhD.

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, 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: 160

A	B	C	D	E	FX
98,75	0,0	0,0	0,0	0,0	1,25

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. RNDr. Peter Moczo, 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. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-105/15	Statistical Methods of Data Analysis

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

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: homeworks, test
Weight of the exam in the final evaluation: 0%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 100/0

Learning outcomes:
After completing the course, students will be able to use statistical approaches to process measured data.

Class syllabus:
Random phenomenon, operations with phenomena, probability of a phenomenon and its properties. Independence of phenomena. Bayesian theorem. Random variable of discrete type. Random variable of continuous type. Different types of distribution of random variables. Generation of random variables.
Point and interval estimates. Testing of statistical hypotheses - parametric and nonparametric tests. Multidimensional data processing - independence tests.
Regression and correlation analysis. Correlation. Theoretical and empirical regression function. Linear regression. Least squares method. Quality of regression function and intensity of dependence. Regression significance test.

Recommended literature:
Hogg, R., Tanis, E., Zimmerman, D.: Probability and Statistical Inference. Pearson Education 2014.
Hogg, R., Ledolter, J.: Applied Statistics for Engineers and Physical Scientists. Maxwell Macmillan International 1987.

Languages necessary to complete the course:
English

Notes:
Any number of students.

Past grade distribution
Total number of evaluated students: 13

A	B	C	D	E	FX
61,54	23,08	7,69	7,69	0,0	0,0

Lecturers: doc. Mgr. Jozef Kristek, DrSc., RNDr. Róbert Kysel, PhD.

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-437/15	Structure of the Earth

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:

Course requirements:
Weight of the exam in the final evaluation: 100%.
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively.
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): 0/100

Learning outcomes:
Know the basics of seismology and knowledge of the physical properties and the structure of the Earth.

Class syllabus:
Some basics of seismology, rays, elements of refraction and reflection seismology, surface waves, travel times in a spherical Earth, inversion for 1D Earth structure, determination of density in the Earth, composition of the Earth`s interior, Moho, upper mantle triplications and discontinuities, core-mantle boundary structure, properties and rheological stratification of the Earth's interior, heat flow and thermal structure of the Earth, mantle viscosity, determination of lateral heterogeneity, travel-time tomography, if time then finite-frequency tomography, use of amplitudes, arguments for inner-core rotation.

Recommended literature:
Interior structure of the earth and planets / Vladimir Naumovič Zharkov; translated from the Russian by William B. Hubbard and Ronald A. Masteler. Chur, Switzerland ; New York : Harwood Academic Publishers, 1986
Stein, S., Wysession, M.: An introduction to seismology, earthquakes, and Earth structure. Blackwell 2009.
Anderson, D. L.: New Theory of the Earth. Cambridge University Press 2007.

Languages necessary to complete the course:
English

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 12

A	B	C	D	E	FX
33,33	33,33	16,67	16,67	0,0	0,0

Lecturers: Univ.-Prof. Dr. Götz Bokelmann, Dr. Yang Lu

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FFZa-438/15	Tectonophysics

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: 3.

Educational level: II.

Prerequisites:

Course requirements:
Weight of the exam in the final evaluation: 100%
Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 0/100

Learning outcomes:
Know basics of regional geodynamics and seismotectonics.

Class syllabus:
Recall of mechanical bases (stress and strain again, friction, rate-and-state-dependent friction, poroelasticity).
Global tectonics (brief history, plates, plate kinematics, triple points, plate-driving forces, geodynamical processes, structure of oceanic and continental lithosphere, types of plate boundaries), subduction zones, lithospheric dynamics, rheological stratification of the lithosphere, modern constraints from global geodesy)
Mechanics of fault systems (stick-slip, creep, indicators of current and ancient strain, state of stress, World stress map, earthquake geodesy, earthquake cycle, seismotectonics, deep earthquakes, stress-loading models, modeling of regional deformation, earthquake phenomenology, earthquake statistics, regional examples)
Fault behaviour (dislocation models, earthquake mechanics, geological deformation mechanisms, postseismic relaxation, time scales of fault deformation, dilatancy- and shattering effects of earthquakes, induced seismicity).

Recommended literature:
Geodynamics / Donald Lawson Turcotte, Gerald Schubert. Cambridge : Cambridge University Press, 2002.
Jaeger, J.C., Cook, N.G.W., Zimmerman, R.W.: Fundamentals of rock mechanics. Blackwell 2008.

Scholz, C.H.: The mechanics of earthquakes and faulting. Cambridge University Press 2008.
Stein, S., Wysession, M.: An introduction to seismology, earthquakes, and Earth structure. Blackwell 2009.

Languages necessary to complete the course:
English

Notes:
The course is held in Vienna, Austria. Any number of students.

Past grade distribution
Total number of evaluated students: 12

A	B	C	D	E	FX
50,0	41,67	0,0	8,33	0,0	0,0

Lecturers: Univ.-Prof. Dr. Götz Bokelmann, Dr. Saikiran Tharimena

Last change: 27.01.2022

Approved by: prof. RNDr. Peter Moczo, DrSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAFZM/2-FFZa-991/15	**Course title:** Thesis Defence
Number of credits: 2	
Educational level: II.	
Course requirements: Weight of the exam in the final evaluation: 100%. Earn at least 90%, 80%, 70%, 60% or 50% of all points for earning grade A, B, C, D or E, respectively. 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): 0/100	
Learning outcomes: Defended Master thesis.	
Class syllabus: Presentation of the content of the master thesis with focus on the student's own contribution. Answering the opponent's questions and questions in the discussion.	
State exam syllabus:	
Languages necessary to complete the course: English	
Notes: Any numer of students.	
Last change: 28.01.2022	
Approved by: prof. RNDr. Peter Moczo, DrSc.	