Course descriptions

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COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

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

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

Number of credits: 6

Recommended semester:

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 22

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

Lecturers: prof. Ing. Igor Farkaš, Dr.

Last change:

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-145/00	Asteroids

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: FMFI.KAFZM/2-FAA-116/15 - Interplanetary Matter (1)

Course requirements:
Continuous Assessment : test (70 points), home assignments (10 points), consultation (20 points)
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
The location of stable orbits in the Solar System, resonances, families, cumulative distribution, unstable orbits. Meteorites, theories of Solar System origin. The methods (and techniques) of explorations – photometry, polarimetry, radiometry, spectroscopy, spectrophotometry, radar. The composition, albedo, taxonomic types, comparison with comets and meteorites. Near-Earth objects, the frequency of falls on Earth (craters, bolides). Nongravitational effects acting on small asteroids.

Recommended literature:
W. F. Bottke Jr. Et al., 2002, Asteroids III
P. Michel, F.E. DeMeo, W.F. Bottke, 2015 Asteroids IV

Languages necessary to complete the course:
Slovak / English

Notes:
If only one student is enrolled the lessons are done via emails.

Past grade distribution
Total number of evaluated students: 22

A	B	C	D	E	FX
90,91	0,0	0,0	4,55	4,55	0,0

Lecturers: Mgr. Adrián Galád, PhD.

Last change: 11.05.2024

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-152/14	Astrobiology

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: I., II.

Prerequisites:

Course requirements:
Continuous Assessment : project and presentation (50%), assignments/tests after chapters/blocks (40%), activitiy/participation during the lectures (10%).
Approximate scale of final grades: A = at least 90%, B = at least 80%, C = at least 70%, D = at least 60%, E = at least 50%, Fx = below 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The aim of this course is to provide students with up-to-date knowledge of astronomical and biological aspects of the origin of life including conditions required to harbor life on our home planet and elsewhere in the universe.

Class syllabus:
Astrobiology as a research field - introduction. Stars, planets, exoplanets. Conditions on early Earth. Comets and asteroids – sources of organic compounds. Habitable zone and terrestrial planets (HZ definition, search for life on Mars). Other life-supporting regions in the Solar system. Conditions for emergence of life on early Earth – biogenic elements and their origin in nucleosynthesis, water – mandatory but not sufficient condition for life as we know it, evidence of the first life forms, alternatives to water-carbon based life. Abiogenesis – RNA, LUCA and central dogma of molecular biology. Evolution and domains of life. Impacts and global cataclysms, major extinctions. Influence of the Moon on the stability of the biosphere. Physical and chemical limits of the biosphere - extremophiles. Biosignatures and their observation in space. Emergence of complex and intelligent life. Drake’s equation and it’s relevance for astrobiology. Fermi’s paradox. Extraterrestrial civilizations and impacts of their potential discovery.

Recommended literature:
COCKELL, CH. S.: Astrobiology – Understanding Life in the Universe (2nd edition), Hoboken: Wiley-Blackwell (2020).
DOMAGAL-GOLDMAN, S. D. – WRIGHT, K.E. et al.: The Astrobiology Primer v 2.0., Astrobiology, 16 (2016).

GARGAUD, M. – LÓPEZ-GARCIA, P. – HERVÉ, M.(eds.): Origins and Evolution of Life: An Astrobiological Perspective, Cambridge, UK: Cambridge University Press (2011).
ROTHERY, D. – GILMOUR, I. – SEPHTON, M.: An Introduction to Astrobiology, Cambridge, UK: Cambridge University Press (2018).

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 37

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

Lecturers: RNDr. Tomáš Paulech, PhD.

Last change: 16.05.2024

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-205/00	Astronomical Instruments

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:
Continuous Assessment : home assignments
Final Examination : oral exam
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
After completing the course, students will have knowledge of astronomical instruments and the possibility of their application in astronomical observations.

Class syllabus:
Instruments and techniques for the optical region: basic types of telescopes, optical aberrations, telescope mountings and control systems, atmospheric observational effects, active and adaptive optics, ground and space based telescopes. Detectors for optical, near infrared and ultraviolet regions: the eye, photovoltaic cells, photomultipliers, image intensifiers, CCD, CMOS, increasing of signal to noise ratio. Instruments for spectroscopy and polarimetry. Instruments and techniques for astronomical image processing: digitization, standard astronomical graphical formats, basic algorithms and image transforms in astronomy. Instruments for radioastronomy: detectors, receivers, radiotelescopes, radars. Instruments for solar physics: solar telescopes, narrow band filters, spectroheliograph, coronograph.

Recommended literature:
Frederick R. Chromey: To Measure the Sky. Cambridge University press 2010
Richard Berry, James Burnell: The Handbook of Astronomical Image Processing. Willmann-Bell Inc., 2005

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution Total number of evaluated students: 52					
A	B	C	D	E	FX
65,38	25,0	9,62	0,0	0,0	0,0
Lecturers: Ing. Pavol Zigo, PhD., doc. RNDr. Leonard Kornoš, PhD.					
Last change: 14.05.2024					
Approved by: prof. Ing. Pavel Mach, CSc.					

STATE EXAM DESCRIPTION

Academic year: 2024/2025	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAFZM/2-FAA-955/15	**Course title:** Astrophysics
Number of credits: 2	
Educational level: II.	
Learning outcomes: The students will proof the understanding of radiative transfer and the structure and evolution of stars.	
Class syllabus: Blackbody radiation, Stefan-Boltzmann law, specific intensity, flux, K-integral, Absorption and emission coefficient, Source function, Transfer equation, Radiative equilibrium and Milne equations, Grey atmosphere, Continuum absorption coefficient, Model atmosphere, Line absorption, Behavior of spectral lines, Chemical analysis and the line transfer equation, Stellar rotation, Turbulence in stellar atmospheres. Sources of stellar energy, Time scales, Conservation laws, The equations of stellar evolution, Properties of matter and energy transport, Nuclear reactions, Nuclear reaction rates and Gamow peak, Equilibrium stellar configurations, The stability of stars (thermal instability in degenerate gas, thin shell instability, dynamic instability, convection), Stellar evolution in rho-T diagram, An evolution of the stellar core and a structure of the star, The pre-main-sequence phase in HR diagram, Stellar evolution on the main sequence, Evolution away from main-sequence in HR diagram, Final stages of stellar evolution.	
State exam syllabus:	
Recommended literature: LeBlanc, F. (2010) An Introduction to Stellar Astrophysics, Wiley Gray, D. F. (1992) The Observation and Analysis of Stellar Photospheres, Cambridge University Press Mihalas, D. (1978) Stellar Atmospheres, W. H. Freeman Prialnik, D. (2009) An Introduction to the Theory of Stellar Structure and Evolution, Cambridge University Press, 2nd edition	
Last change: 25.01.2022	
Approved by: prof. Ing. Pavel Mach, CSc.	

STATE EXAM DESCRIPTION

Academic year: 2024/2025	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAFZM/2-FAA-956/15	**Course title:** Celestial Mechanics
Number of credits: 2	
Educational level: II.	
Learning outcomes: The students will proof the understanding of two and n body problem.	
Class syllabus: Two-body problem. Central orbits. General integrals of motion. Conservation laws. Relationship between integral constants and orbital parameters. Kepler's laws. Gauss's constant, astronomical unit, masses of planets. Energy integral and limits of velocities. Elliptical, parabolic and hyperbolic motion. Solution of Kepler's equation. Orbit in space. Types of orbits in the Solar system. Ephemeris calculation. Time series. Fundamentals of orbit determination. N-body problem. General integrals. Relative coordinates, concept of preturbations, disturbing function. Virial Theorem. General integrals of the n-body motion. Disturbing function. Perturbed orbits. Small impulses and the change of orbital elements. Lagrange's planetary equations, 1-st order solution. Introduction to resonances. Restricted three-body problem. Jacobi integral. Lagrangian equilibrium points, stable and unstable solution. Tisserand invariant. Gravitational spheres. Numerical solution of n-body problem, Cowell and Encke type. Gravitational potential of a finite body. Perturbations in satellite motion.	
State exam syllabus:	
Recommended literature: Danby, J. M. A.: Fundamentals of Celestial Mechanics, Richmond, 1992 Murray, C.D., Dermott, S.F.: Solar System Dynamics, Cambridge University Press, 1999 Roy Archie E.: Orbital motion, Bristol : Institute of Physics Publishing, 2005 Brouwer, D., Clemence, G.: Methods of Celestial Mechanics, London 1961 Andrle, P.: Základy nebeské mechaniky, Praha, 1971	
Last change: 26.01.2022	
Approved by: prof. Ing. Pavel Mach, CSc.	

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-105/22	Celestial Mechanics (1)

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

Number of credits: 7

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment (20%): home assignments
Final Examination (80%): written test (15 points) and oral exam (65 points)
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
The course provides an introduction to astrodynamics, two-body problem, basics of orbit determination. Introduction to the n-body problem.

Class syllabus:
Two-body problem. Central orbits. General integrals of motion. Conservation laws. Relationship between integral constants and orbital parameters. Kepler's laws. Gauss's constant, astronomical unit, masses of planets. Energy integral and limits of velocities. Elliptical, parabolic and hyperbolic motion. Solution of Kepler's equation. Orbit in space. Types of orbits in the Solar system. Ephemeris calculation. Time series. Fundamentals of orbit determination. N-body problem. General integrals. Relative coordinates, concept of preturbations, disturbing function. Introduction to perturbations. Virial Theorem.

Recommended literature:
Andrle, P.: Základy nebeské mechaniky, Praha, 1971
Danby, J. M. A.: Fundamentals of Celestial Mechanics, Richmond, 1992
Archie E. Roy: Orbital motion, Bristol : Institute of Physics Publishing, 2005
Murray, C.D., Dermott, S.F.: Solar System Dynamics, Cambridge University Press, 1999
Brouwer, D., Clemence, G.: Methods of Celestial Mechanics, London 1961

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution Total number of evaluated students: 62					
A	B	C	D	E	FX
82,26	8,06	9,68	0,0	0,0	0,0
Lecturers: doc. RNDr. Leonard Kornoš, PhD.					
Last change: 21.06.2022					
Approved by: prof. Ing. Pavel Mach, CSc.					

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-106/00	Celestial Mechanics (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:

Course requirements:
Continuous Assessment (30%): home assignments (20%), presentation (10%)
Final Examination (70%): oral exam
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
Fundamentals of the three-body and the n-body problem. General and special perturbations, secular motion. Motion in the field of a finite body.

Class syllabus:
General integrals of the n-body motion. Disturbing function. Perturbed orbits. Small impulses and the change of orbital elements. Lagrange's planetary equations, 1-st order solution. Introduction to resonances. Restricted three-body problem. Jacobi integral. Lagrangian equilibrium points, stable and unstable solution. Tisserand invariant. Gravitational spheres.
Numerical solution of n-body problem, Cowell and Encke type.
Gravitational potential of a finite body. Perturbations in satellite motion.

Recommended literature:
Danby, J. M. A.: Fundamentals of Celestial Mechanics, Richmond, 1992
Murray, C.D., Dermott, S.F.: Solar System Dynamics, Cambridge Univ. Press, 1999
Brouwer, D., Clemence, G.: Methods of Celestial Mechanics, London, 1961
Archie E. Roy: Orbital motion, Bristol : Institute of Physics Publishing, 2005
Andrle, P.: Základy nebeské mechaniky, Praha, 1971

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution Total number of evaluated students: 59					
A	B	C	D	E	FX
74,58	20,34	3,39	0,0	1,69	0,0
Lecturers: doc. RNDr. Leonard Kornoš, PhD.					
Last change: 21.06.2022					
Approved by: prof. Ing. Pavel Mach, CSc.					

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-150/11	Comets

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: FMFI.KAFZM/2-FAA-116/15 - Interplanetary Matter (1)

Course requirements:
Continuous Assessment : home assignments (20 points), presentation (30 points), test (50 points)
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The student will gain a detailed overview of the main and latest knowledge in comet research. Their position and connection with other components of MPH will be approached.

Class syllabus:
Introduction – comets in the context of small bodies of the Solar System, morphology and phenomena. History of comet observation. Dynamic classification and evolution of comets from the Oort cloud to dark comets and meteor streams. Physics of comets: origin and development of cometary activity, coma and tail, volatiles and sublimation, thermal transformation of cometary nuclei. Theories of the formation of the Solar System and comets, planetary migration and the formation of cometary reservoirs. Sizes, composition, shape and albedo of cometary nuclei – comparison with small bodies of the Solar System. Methods of comet research – specifics of astrometry, photometry, polarimetry, radiometry, spectroscopy, spectrophotometry, radar. Information from space missions to comets, Rosetta-Philae. Comets and planetary defense. Interstellar comets and their sources.

Recommended literature:
Comets II, eds. M.C. Festou, H.U. Keller, and H.A. Weaver, The University of Arizona Press, 2004.
Selected papers and Conference Proceedings

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 15

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

Lecturers: Mgr. Eva Lilly, PhD.

Last change: 14.01.2025

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FOZ-156/15	Computational Methods in Liquid Dynamics

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: 4.

Educational level: II.

Prerequisites:

Course requirements:
Preliminary evaluation: independent work
Final exam: oral / written
Indicative evaluation scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
Application of numerical procedures to solve meteorological and climatological problems.

Class syllabus:
Computer arithmetic, error propagation in calculations, interactive solution of nonlinear equations, interpolation, approximation of functions. Orthogonal Chebyshev and Legendre polynomials, discrete integral approximation, Newton-Cotes method, Gaussian integration. Determination of eigenvalues of selected matrices, diagonalization of matrices, compilation and solution of discrete forms of selected differential equations describing fluid dynamics, Initial value problem, nondimensional equation, solution of integral equations, issues of uniqueness, consistency, stability and thus convergence of the solution, Euler's method of solution diff. equations, Runge-Kutta methods, multistep methods, Predictor-corrector method. The topics are focused to solve problems in meteorology and climatology.

Recommended literature:
Numerické metody matematické analýzy / Petr Přikryl. Praha : Státní nakladatelství technické literatury, 1988
Základy numerické matematiky / Anthony Ralston ; přeložili z anglického originálu Milan Práger, Emil Vitásek. Praha : Academia, 1978
Theoretical Numerical Analysis, A Functional Analysis Framework / Atkinson, Kendall, Han, Weimin, Series: Texts in Applied Mathematics, Vol. 39., 3rd ed., Springer, 2009

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

Notes:

Past grade distribution
Total number of evaluated students: 14

A	B	C	D	E	FX
21,43	14,29	42,86	14,29	7,14	0,0

Lecturers: doc. RNDr. Martin Gera, PhD.

Last change: 14.03.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-149/15	Computers in Astronomy (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: 2.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: individual task.
Rating scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students will acquire basic skills for work with astronomical libraries in Python. These skills will cover areas like FITS image processing, object's ephemeris prediction on celestial sphere, application of numerical integration in astronomy and visualization of obtained scientific data.

Class syllabus:
Work with Python libraries such as installation, basic set-up, input parameters, usage of functions, programming own scripts. Work with FITS images covering image calibration, segmentation and astrometric reduction. Calculation of object's ephemerides, coordinates transformation, own scripts development. Usage of Python libraries Python libraries AstroPy, SciPy, NumPy, matplotlib, rebound, SourceExtractor, and sgp4.

Recommended literature:
Mark Summerfield; Python 3
P. L. Shopbell, M. C. Britton, & R. Ebert (San Francisco: ASP), Flexible Image Transport System (FITS), 1999, NOST 100-2.0.
Library Astropy: http://docs.astropy.org/en/stable/#user-documentation.

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 31

A	B	C	D	E	FX
74,19	3,23	9,68	3,23	9,68	0,0

Lecturers: Mgr. Jiří Šilha, PhD.
Last change: 17.02.2022
Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-249/19	Computers in Astronomy (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: 3.

Educational level: II.

Prerequisites:

Recommended prerequisites:
Basic in C/C++

Course requirements:
Continuous Assessment : home assignments: the percentage for evaluation is given by the ratio of completed to total number of assignments
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students will be able to solve simple astronomical problems on a computer, work with documentation, use existing libraries in their programs, work with Linux.

Class syllabus:
Solving astronomical problems on a computer: time measurement, coordinate systems, planetary motion, Kepler and perturbation ephemeris. Use of programming in C / C ++ and Linux OS.

Recommended literature:

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 8

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

Lecturers:

Last change: 21.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-111/15	Cosmic Electrodynamics (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:
Continuous Assessment (20%): home assignments 20points; min 12 points
Final Examination (80%): test 60 points, oral exam 10points, presentation 10points
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
Understanding the basics of astrophysical plasma.

Class syllabus:
Introduction (ionization, radiation, …), Criteria of plasma, (macroscopic neutrality, Debye shielding, plasma frequency), Plasma in the Universe (Sun, solar wind, ionosphere, magnetosphere), Plasmatic devices (tokamak, plasma propulsion, MHD generator), General properties of plasma, Motion of charged particle in uniform static magnetic field (gyration, helical motion, magnetic moment, magnetization current), Motion in uniform static electromagnetic field (plasma drift, cycloid, Hall current, gravitation field drift), Motion in nonuniform static electromagnetic field (Alfvén approximation, gradient, divergence and curvature terms, curvature and gradient drift, adiabatic invariants, magnetic mirror, tokamak), Motion in time-varying electromagnetic field (polarization drift, mobility dyad, cyclotron resonance, magnetic moment invariant, magnetic compression).

Recommended literature:
Bittencourt, J. A. (2004) Fundamentals of plasma physics, Springer, New York, 3rd edition, 679 pp.
Inan, U. a Golkowski M. (2011) Principles of Plasma Physics for Engineers and Scientists, Cambridge University Press, 286 pp.

Languages necessary to complete the course:
slovak, english

Notes:

Past grade distribution Total number of evaluated students: 36					
A	B	C	D	E	FX
44,44	41,67	0,0	2,78	11,11	0,0
Lecturers: doc. RNDr. Jozef Klačka, PhD.					
Last change: 21.06.2022					
Approved by: prof. Ing. Pavel Mach, CSc.					

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-112/15	Cosmic Electrodynamics (2)

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: FMFI.KAFZM/2-FAA-111/15 - Cosmic Electrodynamics (1)

Course requirements:
Continuous Assessment (100%): home assignments 20points, presentation 10points;
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Continuous Assessment / Final Examination: 100/0
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
Understanding the basics of magnetohydrodynamic and plasma waves.

Class syllabus:
Kinetic theory (relaxation, Boltzmann equation and its moments, Vlasov equation, macroscopic variables, macroscopic transport equations – continuity equation, equation of motion, energy transport equation), Basics of magnetohydrodynamic (MHD equations, Ohm law, Simplified MHD equations), Magnetic Reynolds number, Diffusion of magnetic field, Freezing of magnetic field lines in plasma, Waves in plasma (sound waves, magnetic pressure, Alfvén and magnetoacustic waves, phase velocity diagram), Attenuation of MHD, Alfvén, sound and magnetosonic waves, Waves in cold and hot plasma and resonances.

Recommended literature:
Bittencourt, J. A. (2004) Fundamentals of plasma physics, Springer, New York, 3rd edition, 679 pp.
Inan, U. a Golkowski M. (2011) Principles of Plasma Physics for Engineers and Scientists, Cambridge University Press, 286 pp.

Languages necessary to complete the course:
slovak, english

Notes:

Past grade distribution
Total number of evaluated students: 22

A	B	C	D	E	FX
90,91	4,55	4,55	0,0	0,0	0,0

Lecturers: RNDr. Roman Nagy, PhD.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/2-FTF-213/00	Cosmology

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

Number of credits: 6

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: homework
Exam: exam
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
After completing the course, students will know the basic concepts and ideas of the standard model in cosmology and know how to determine the cosmological parameters from the data of observations on anisotropies of relic radiation.

Class syllabus:
- dynamics of the Universe
- physical processes in the early Universe
- anisotropies of the cosmic background radiation and the origin of galaxies

Recommended literature:
Fundamentals of cosmology / James Rich. Berlin : Springer, 2001
J. García-Bellido: Astrophysics and Cosmology, hep-ph/0004188

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 52

A	B	C	D	E	FX
67,31	17,31	9,62	3,85	1,92	0,0

Lecturers: Mgr. Peter Mészáros, PhD.

Last change: 25.02.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-910/22	Diploma Seminar

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

Number of credits: 5

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment : home assignments
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
By completing the seminar, students will be able to categorize scientific literature and perform analysis and synthesis of knowledge gained from literature and master the methods of work on a scientific project related to the topic of his/her thesis. Students will prepare for writing a diploma thesis, learn the methodological procedures of preparing a diploma thesis, gain an overview of the current state of literature on the topic of the thesis, learn the methodology of scientific work, processing and evaluation of results.

Class syllabus:
Methodical procedures for elaboration of the structure and time schedule of the assigned project; work with scientific literature; methods of data collection. Written processing of assigned topics according to specific thesis assignments. Clear formulation of the content and objectives of the work, investigation procedures, analysis of ambiguities, partial presentations of results on the assigned topic of the thesis. Joint interactive analysis of individual presentation performances and critical discussion. Gradual presentation of the state of development of the theses of individual students. Discussion of used methods, results and literature overview.

Recommended literature:
Selection of up-to-date articles and recommended monographs.
Ako písať vysokoškolské a kvalifikačné práce : Ako písať seminárne práce, ročníkové práce, práce študentskej vedeckej a odbornej činnosti, diplomové práce, záverečné a atestačné práce, dizertácie / Dušan Katuščák. Bratislava : Stimul, 1998

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 56

A	B	C	D	E	FX
89,29	3,57	5,36	1,79	0,0	0,0

Lecturers: doc. RNDr. Leonard Kornoš, PhD., doc. RNDr. Jozef Klačka, PhD., doc. RNDr. Juraj Tóth, PhD.

Last change: 02.03.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-911/22	Diploma Thesis

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

Number of credits: 5

Recommended semester: 4.

Educational level: II.

Prerequisites:

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

Learning outcomes:
Acquire the basics of scientific work and how to write a final thesis.

Class syllabus:
Individual student student work, consultations with the diploma thesis supervisor.

Recommended literature:
According to the recommentation of the thesis supervisor and one's own choice.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 56

A	B	C	D	E	FX
89,29	3,57	5,36	0,0	1,79	0,0

Lecturers: doc. RNDr. Leonard Kornoš, PhD., doc. RNDr. Jozef Klačka, PhD., doc. RNDr. Juraj Tóth, PhD.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

STATE EXAM DESCRIPTION

Academic year: 2024/2025	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAFZM/2-FAA-991/22	**Course title:** Diploma Thesis Defense
Number of credits: 15	
Recommended semester: 3., 4..	
Educational level: II.	
State exam syllabus:	
Last change: 20.01.2022	
Approved by: prof. Ing. Pavel Mach, CSc.	

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: II.

Prerequisites:

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

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

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

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

Languages necessary to complete the course:
Slovak or English

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

Past grade distribution
Total number of evaluated students: 95

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

Lecturers: doc. RNDr. Mária Markošová, PhD.

Last change: 22.08.2021
Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: II.

Prerequisites:

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

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

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

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

Languages necessary to complete the course:
Slovak or English

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

Past grade distribution
Total number of evaluated students: 95

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

Lecturers: doc. RNDr. Mária Markošová, PhD.

Last change: 22.08.2021
Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., II.

Prerequisites:

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

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

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

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

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 201

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

Lecturers: Mgr. Aneta Barnes

Last change: 11.04.2024
Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-151/14	Exoplanets

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

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment : home assignments (50 points) , presentation (50 points)
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The student will gain basic and latest knowledge about extrasolar planets: current state, detection methods, physical properties, evolution and future research.

Class syllabus:
Current state of exoplanet research, detection methods: radial velocities, transits, microlenses, direct imaging, astrometry, transition timing, exoplanet atmosphere and interior, orbital development and dynamics, migration, Kepler orbits, habitable zone, moons of exoplanets, multiple star planets systems, free exoplanets, resonant orbits, protoplanes, dust disks, the future of exoplanet research.

Recommended literature:
An introduction to the Sun and Stars / S. Jocelyn Bell Burnell ... [et al.]. Cambridge : Cambridge University Press, 2004
Selected papers in the field

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 10

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

Lecturers: RNDr. Mária Hajduková, PhD.

Last change: 21.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-135/22	Field Practice

Educational activities:
Type of activities: practice
Number of hours:
per week: **per level/semester:** 40s
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment : astronomical observation, protocols
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Acquisition of scientific observation skills and habits, practical use of instrumentation, processing of own acquired data.

Class syllabus:
Preparation and implementation of observations in the field of interplanetary matter, solar physics, stellar and galactic astronomy. Familiarization with instrumentation and its control. Acquisition of observation data, its processing, analysis, archiving and discussion of the obtained results.

Recommended literature:
Selected papers and manuals on the issue.

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 40

A	B	C	D	E	FX
97,5	0,0	2,5	0,0	0,0	0,0

Lecturers: RNDr. Štefan Gajdoš, PhD., doc. RNDr. Leonard Kornoš, PhD., Mgr. Adrián Galád, PhD., RNDr. Roman Nagy, PhD.

Last change: 11.05.2024

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., II.

Prerequisites:

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

Learning outcomes:

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

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

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 307

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

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., II.

Prerequisites:

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

Learning outcomes:

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

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

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 79

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

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

STATE EXAM DESCRIPTION

Academic year: 2024/2025	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAFZM/2-FAA-959/15	**Course title:** Galactic and Extra-Galactic Astronomy
Number of credits: 2	
Educational level: II.	
Learning outcomes: The students will gain and proof the overview and understanding of the-state-of-the-art knowledge in the field of galactic and extragalactic astronomy.	
Class syllabus: Galactic coordinates and proper motions in galactic coordinates; Solar motion, Local standard of rest (LSR); theory of galactic rotation; Oort's equations and constants; rotation curve, dark matter; spiral structure of the Galaxy; galactic bar; stellar dynamics; regular and irregular forces in stellar systems; basic equation of stellar dynamics; characteristics of trajectories of stars; perturbations: epicyclic motion in the galactic plane and cyclic motion in a plane normal to the galactic plane; dark matter dynamics and generalized gravity, apparent distribution of stars, differential and integral function of brightness, luminosity function, interstellar absorption. Models of the Galaxy; Galactic structures: spiral arms, galactic warp and flare, stellar streams; resonances in the Galaxy; classification of galaxies, their structure, and properties; methods of determining galactic masses and distances; radial galactic velocities, redshift, and Hubble's law; galactic gas; space distribution of galaxies, local group of galaxies, clusters of galaxies; basics of galactic evolution; galactic mergers and interaction with intergalactic gas; active galaxies, galactic nuclei, quasars.	
State exam syllabus:	
Recommended literature: An introduction to galaxies and cosmology / edited by Mark H. Jones and Robert J. Lambourne. Cambridge : Cambridge University Press, 2004 Maoz, D. (2016) Astrophysics in a nutshell, Princeton University Press, 2nd edition Binney, J, Tremaine S. (2008) Galactic Dynamics, Princeton University Press, 2nd edition Sparke, L. S., Gallegher, J. S. (2007) Galaxies in the Universe, Cambridge University Press Padmanabhan, T. (2002) Theoretical astrophysics: Volume 3: Galaxies and cosmology, Cambridge University Press	
Last change: 25.01.2022	
Approved by: prof. Ing. Pavel Mach, CSc.	

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-125/00	Galactic and Extra-Galactic Astronomy (1)

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

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment (30%): home assignments 20points, presentation 10points; min 18 points
Final Examination (70%): test 60 points, oral exam 10points,
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
To gain basic knowledge of the Galactic structure and the motions of Galactic objects. Students will be able to study and understand the-state-of-the-art scientific papers and/or be able to independently recalculate the published results.

Class syllabus:
spherical astronomy – galactic coordinates and proper motions in galactic coordinates; Solar motion, Local standard of rest (LSR); theory of galactic rotation; Oort's equations and constants; rotation curve, dark matter; spiral structure of the Galaxy; galactic bar; stellar dynamics; regular and irregular forces in stellar systems; basic equation of stellar dynamics; characteristics of trajectories of stars; perturbations: epicyclic motion in the galactic plane and cyclic motion in a plane normal to the galactic plane; dark matter dynamics and generalized gravity, apparent distribution of stars, differential and integral function of brightness, luminosity function, interstellar absorption.

Recommended literature:
Binney J., Merrifield M.: 1998, Galactic Astronomy, Princeton University Press, Princeton
Scheffler H., Elsasser H.: 1988, Physics of the Galaxy and Interstellar Matter, Springer-Verlag, Berlin
Binney J., Tremaine S.: 2008, Galactic Dynamics, Princeton University Press, Princeton
Kulikovskij P. G.: 1985, Zvezdnaja astronomija, Nauka, Moskva
Mihalas D., Binney J.: 1981, Galactic Astronomy, W. H. Freeman and Company, San Francisco
Mihalas D., McRae Routly P.: 1968, Galactic Astronomy, W. H. Freeman and Company, San Francisco
Sparke L. S., Gallagher J. S.: 2007, Galaxies in the Universe: An Introduction. Cambridge University Press, Cambridge

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 59

A	B	C	D	E	FX
79,66	11,86	1,69	5,08	1,69	0,0

Lecturers: doc. RNDr. Jozef Klačka, PhD.

Last change: 21.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-225/22	Galactic and Extra-Galactic Astronomy (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: 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment (30%): home assignments 20points, presentation 10points; min 18 points
Final Examination (70%): test 60 points, oral exam 10points,
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Continuous Assessment / Final Examination: 30/70
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
To gain basic knowledge about galaxies in the Universe, their structure, kinematic and dynamic. Students will be able to study and understand the-state-of-the-art scientific papers.

Class syllabus:
Models of the Galaxy; Galactic structures: spiral arms, galactic warp and flare, stellar streams; resonances in the Galaxy; classification of galaxies, their structure, and properties; methods of determining galactic masses and distances; radial galactic velocities, redshift, and Hubble's law; galactic gas; space distribution of galaxies, local group of galaxies, clusters of galaxies; basics of galactic evolution; galactic mergers and interaction with intergalactic gas; active galaxies, galactic nuclei, quasars.

Recommended literature:
Sparke, L. S., Gallegher, J. S. (2007) Galaxies in the Universe, Cambridge University Press
Maoz, D. (2016) Astrophysics in a nutshell, Princeton University Press, 2nd edition
Binney, J, Tremaine S. (2008) Galactic Dynamics, Princeton University Press, 2nd edition
Padmanabhan, T. (2002) Theoretical astrophysics: Volume 3: Galaxies and cosmology, Cambridge University Press

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution Total number of evaluated students: 57					
A	B	C	D	E	FX
71,93	15,79	8,77	1,75	1,75	0,0
Lecturers: RNDr. Roman Nagy, PhD., doc. RNDr. Jozef Klačka, PhD.					
Last change: 20.06.2022					
Approved by: prof. Ing. Pavel Mach, CSc.					

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/2-FTF-117/00	General Relativity

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

Number of credits: 7

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: homework
Exam: exam
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
After completing the course, students will know how the general theory of relativity is constructed and will be acquainted with its most important applications

Class syllabus:
Description of gravity in general relativity (metric space-time tensor, equations of motion of matter in the gravitational field, Einstein's equations), applications of general relativity (post-Newtonian approximation, relativistic stars and black holes, gravitational waves, relativistic cosmological models)

Recommended literature:
Ch. W. Misner, K. S. Thorne, J. A. Wheeler: Gravitation, W. H. Freeman and Comp., San Francisco (1973), Princeton University Press (2017)
A first course in general relativity / Bernard F. Schutz. Cambridge : Cambridge University Press, 1985
Spacetime and geometry : An introduction to general relativity / Sean Carroll. San Francisco : Addison Wesley, 2004

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution Total number of evaluated students: 65					
A	B	C	D	E	FX
49,23	26,15	16,92	6,15	1,54	0,0
Lecturers: Mgr. Samuel Kováčik, PhD., Mgr. Peter Mészáros, PhD.					
Last change: 25.02.2022					
Approved by: prof. Ing. Pavel Mach, CSc.					

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

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. Ing. Pavel Mach, CSc.

STATE EXAM DESCRIPTION

Academic year: 2024/2025	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAFZM/2-FAA-957/15	**Course title:** Interplanetary Matter
Number of credits: 2	
Educational level: II.	
State exam syllabus:	
Last change: 02.06.2015	
Approved by: prof. Ing. Pavel Mach, CSc.	

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-116/15	Interplanetary Matter (1)

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:
Continuous Assessment (30%) : home assignments (10 points)/ presentation (20 points)
Final Examination (70%): oral exam
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
The student will gain basic knowledge in the field of asteroids, comets and transneptunian bodies and an overview of current research.

Class syllabus:
Part of Comet: Components and history of IPM research, spatial distribution of IPM components, orbits, observation methods; Comets and Centauri: classification, observations, discoveries, physical properties, construction and evolution of comets, processes of approach to the Sun, models, active areas, dust, photometry, changes in brightness and aging of comets, decays, non-gravitational effects, Oort cloud, Kuiper belt, missions to comets.
Part of Asteroids: Orbits, main belt and bodies on special orbits, resonances, families, orbital evolution, non-gravitational perturbation, Yarkovsky phenomenon, YORP effect, collisions, impacts, tidal decays, rotation of asteroids - spin barrier, binary asteroids, asteroid composition, asteroid research - astrometry, photometry, spectroscopy, polarimetry, radar, eclipses. NEOs, collisions with the Earth and the risk of impact, survey projects, discoveries, missions to asteroids, the latest findings.
Part Transneptunian bodies: Kuiper belt, discoveries, classification, resonant groups, scattered disk and distant bodies, physical characteristics, spectra, sizes, Pluto, missions.

Recommended literature:
Asteroids IV, eds. P. Michel, F.E. DeMeo, W.F. Bottke Jr., The University of Arizona Press, 2015.
Comets II, eds. M.C. Festou, H.U. Keller, and H.A. Weaver, The University of Arizona Press, 2004.
Selected papers and conference Proceedings

Languages necessary to complete the course:

Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 40

A	B	C	D	E	FX
47,5	30,0	15,0	7,5	0,0	0,0

Lecturers: RNDr. Štefan Gajdoš, PhD., doc. RNDr. Leonard Kornoš, PhD.

Last change: 21.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-117/15	Interplanetary Matter (2)

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:
Continuous Assessment: written homework assignment.
Final Examination: oral exam.
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
Students will learn the physics of the meteoroid interaction with the atmosphere, origin and formation of meteoroid streams, history and methods and analyses of meteors, nature of meteor emission and physical properties of meteoroids. They will also learn about light, sound and impact effects of meteorite falls, their statistics, classification, chemical and mineralogical composition, structural properties, and ages. After completing the course, students will be able to perform basic analysis of meteors and meteoroids, to classify different types of meteorites and distinguish them from terrestrial rocks and materials.

Class syllabus:
Terms in meteor astronomy, history and methods of observations, formation of meteoroid streams, shower and sporadic activity, physics of meteoroid interaction with the atmosphere, nature of meteor emission, basics of spectroscopy and physical properties of meteoroids. Meteorites – statistics, atmospheric interaction. Light, sound and impact effects. Classification, stony, stony-iron and iron meteorites. Antarctic meteorites, Slovak meteorites. Meteorite ages. Meteoritic craters. Differentiation between meteorites and terrestrial minerals.

Recommended literature:
Bronshten, V. A. (1983). The Physics of Meteoritic Phenomena, Reidel, Dordrecht, 880 pp. ISBN 90-277-1654-4
Ceplecha, Zdeněk et al.: Meteor Phenomena and Bodies. Space Science Reviews, v. 84, Issue 3/4, p. 327-471 (1998)
Fyzika sluneční soustavy/ M.Brož, M. Šolc. Matfyzpress, 2013
Selection of current articles in the field of meteor and meteorite research.

Languages necessary to complete the course:

Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 40

A	B	C	D	E	FX
75,0	15,0	7,5	2,5	0,0	0,0

Lecturers: doc. RNDr. Juraj Tóth, PhD., RNDr. Pavol Matlovič, PhD.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-130/00	Laboratory Practice (1)

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

Number of credits: 2

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment: home assignments, protocols
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The student will gain basic knowledge regarding the acquisition, processing and analysis of observation material.

Class syllabus:
Preparing of an observation programs for the astronomical telescope. Astrometric and photometric processing of CCD images. Photometric light curve analysis. Basics of acquisition and processing of video meteors. Meteor observation methods. Astronomical data processing.

Recommended literature:
Asteroids II, 1989, eds. R. P. Binzel, T. Gehrels, M. S. Matthews
MaxIm DL User Guide – CCD camera manual
P. Martinez, A. Klotz: A practical Guide to CCD Astronomy, Cambridge, 1998
Chromey: To Measure the Sky, kapitola 2 Uncertainity, str. 35 - 59
Broz, Wolf: Astronomicka mereni, kapitola 2. Statistika mereni, str. 33 - 45

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 58

A	B	C	D	E	FX
96,55	1,72	1,72	0,0	0,0	0,0

Lecturers: doc. RNDr. Leonard Kornoš, PhD., RNDr. Štefan Gajdoš, PhD., Mgr. Adrián Galád, PhD.

Last change: 28.05.2024
Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-230/00	Laboratory Practice (2)

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

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment : practical exercise, exercise reports: the final grade is given as the average of grades for the individual reports
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
After completing this course, students will be able to independently process and analyze astronomical observations with a focus on subsequent publishing activities.

Class syllabus:
Analysis of radio outbursts from solar flares. Design and analysis of a simple optical system using the OSLO-edu program. Lunar eclipse calculation. Asteroid rotation study based on photometric observations. Determining the observer's geographical position according to the star positions. Reduction and fitting of fireball emission spectra.

Recommended literature:
Kleczek, J.:1987, Exercises in Astronomy, Riedel Publ. Comp., Dordrecht, Holland
OSLO - Optics reference (https://lambdares.com)
Teacher's electronic texts
Chromey: To Measure the Sky, kapitola 2 Uncertainity, str. 35 - 59
Broz, Wolf: Astronomicka mereni, kapitola 2. Statistika mereni, str. 33 - 45

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 55

A	B	C	D	E	FX
92,73	1,82	1,82	1,82	1,82	0,0

Lecturers: Ing. Pavol Zigo, PhD., RNDr. Pavol Matlovič, PhD.

Last change: 28.05.2024
Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: 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, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: 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, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: 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, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: 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, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-146/00	Physics of Planets

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:
Continuous Assessment : home assignments (20 points), presentation (40 points), test (40 points)
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Introduction to planetary physics enabling students to gain an overview of the physical characteristics and evolutionary relationships between solar system objects

Class syllabus:
The exploration of the Solar system and its origin; Mercury; Venus; The Earth; The Moon; Mars; Interiors, surfaces and atmospheres of the terrestrial planets; The interplanetary medium and planetary magnetospheres; Interiors and atmospheres of the giant planets; Io, Europa, Ganymede, Callisto, Titan; Triton, Pluto a Charon; Small and icy moons and planetary rings; Life in the Solar system and other planetary systems.

Recommended literature:
J. Kelly Beatty, Carolyn Collins Petersen, Andrew Chaikin eds.: The New Solar System, Sky Publ. Corp. and Cambridge Univ. Press,1999
T. Encrenaz, J.-P. Bibribg, M. Blanc: 1985 The Solar System, Springer-Verlag
J. K. Beatty, C. C. Petersen, A. Chaikin eds.: 1999, The New Solar System, Sky Publ. Corp. and Cambridge Univ. Press.
B. Bertotti, P. Farinella, D. Vokrouhlický: 2003, Physics of the Solar System, Kluwer Academic Publishers, Dordrecht.
Z. Kopal: 1984, Vesmírní sousedé naší planety, Academia, Praha.
G. Consolmagno, M. Schaefer: Worlds Apart: 1994, A Textbook in Planetary Sciences, Prentice Hall.

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution Total number of evaluated students: 21					
A	B	C	D	E	FX
90,48	9,52	0,0	0,0	0,0	0,0
Lecturers: doc. RNDr. Juraj Tóth, PhD.					
Last change: 21.06.2022					
Approved by: prof. Ing. Pavel Mach, CSc.					

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-248/15	Planetary Cosmogony

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: 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment: preparation and presentation of a paper.
Final Examination: oral exam.
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
The graduate of the course will gain theoretical knowledge of models of the origin and development of planetary systems and will have an overview in the most recent publications in the field of planetary science.

Class syllabus:
Historical models of the formation of the Solar System. Nucleogenesis of chemical elements and their cosmic abundances. Gravitational collapse and the Jeans criterion. Solar System formation, standard model, chemical condensation equilibrium theory of dust formation. Turbulence in protoplanetary disks, collisional growth of planetesimals. Protoplanetary disk structure. Massive disk model - gaseous planets, planet migration. Chronology of the formation of Solar System bodies. Other planetary systems, circumstellar dust disks, the cycle of matter in interstellar clouds.

Recommended literature:
An introduction to the solar system / Philip A. Bland ... [et al.]. Cambridge : Open university, 2004
Fyzika sluneční soustavy/ M.Brož, M. Šolc. Matfyzpress, 2013

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution Total number of evaluated students: 35					
A	B	C	D	E	FX
74,29	20,0	2,86	0,0	2,86	0,0
Lecturers: doc. RNDr. Juraj Tóth, PhD., RNDr. Pavol Matlovič, PhD.					
Last change: 20.06.2022					
Approved by: prof. Ing. Pavel Mach, CSc.					

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-144/00	Population of Meteoroids

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: FMFI.KAFZM/2-FAA-117/15 - Interplanetary Matter (2)

Course requirements:
Continuous Assessment : presentation (50 points), test (50 points)
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The student will gain knowledge about research methods, structure and origin of the meteoroid population.

Class syllabus:
All-sky astrometric reduction. Radians, velocities, calculation of meteoroid orbits, databases. Selection effects, sources of errors. Origin, structure and development of meteoroid streams, general characteristics, effects on meteoroids. Orbital similarity criteria and methods of distinguishing showers from sporadic background. Shower activity and mass inflow to Earth. Main meteor showers, minor showers, associations. Meteor storms. Activity modeling and predictions. Parent bodies of meteoroid strams, meteor complexes. Meteor showers of aasteroidal orgin. Sporadic population and its sources. Zodiacal cloud. Spatial structure and physical characteristics of individual components of the population. Geological periods, impact craters.

Recommended literature:
Murrad E., Williams I.P.: 2002, Meteors in the Earth's Atmosphere. Cambridge, London
Meteoroids. Sources of Meteors on Earth and Beyond. Eds. Ryabova, Asher, Campbell-Brown, 2019

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 29

A	B	C	D	E	FX
89,66	6,9	3,45	0,0	0,0	0,0

Lecturers: doc. RNDr. Leonard Kornoš, PhD., doc. RNDr. Juraj Tóth, PhD., RNDr. Pavol Matlovič, PhD.

Last change: 21.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAMŠ/2-EFM-152/15	Principles of Mathematical Modelling in Science and Engineering

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

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Interim assessment during the semester has a weight of 40% (homeworks 30%, bonus exercises 10%). The two semester exam papers have a total weight of 60% (the first paper taken in the middle of the semester, the second paper taken at the end of the semester). The student must obtain at least half of the points from each semester exam paper. The final evaluation can be adjusted by an oral exam (theoretical questions, written preparation).
Grading: A (100-91), B (90-81), C (80-71), D (70-61), E (60-51), FX (50-0)
Scale of assessment (preliminary/final): Weight of the intermediate / final evaluation: 40/60

Learning outcomes:
By completing this course, the student will gain knowledge of the principles of mathematical modeling of phenomena in the natural and technical sciences.

Class syllabus:
Basic principles of modeling.
Principle of nondimensionalisation. Buckingham Pi-theorem. Dimensionless parameters.
Asymptotic expansion, convergence vs. divergence, uniformity. Matched asymptotic approximations.
Application of asymptotic methods: Van der Pol oscillator.
Heat transfer model. Degenerate diffusion.
Material derivative. Vorticity. Viscous flow.
Flow instability and transition to turbulence.

Recommended literature:
A. C. Fowler, Mathematical Models in the Applied Sciences, Cambridge University Press, 1997
A. Quarteroni, P. Gervasio, A Primer on Mathematical Modelling, Springer, 2020

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution Total number of evaluated students: 91					
A	B	C	D	E	FX
58,24	18,68	8,79	5,49	2,2	6,59
Lecturers: doc. RNDr. Peter Guba, PhD.					
Last change: 22.06.2022					
Approved by: prof. Ing. Pavel Mach, CSc.					

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., II.

Prerequisites:

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

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

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

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

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 435

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

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., II.

Prerequisites:

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

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

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

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

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 153

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

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-240/00	Selected Problems in Astrophysics

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: 4.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment : home assignments
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Student will obtain basic knowledge required for further study and work in the field. Particular attention is given to understanding of the terms, methods and processes that take place in exoplanets and brown dwarfs. Course offers overview of the field with the latest highlights and discoveries.

Class syllabus:
Basic terms, definitions, and processes. Planet detection methods. Cosmic missions. Exoplanet properties and observations. Special and famous exoplanets. Interior (convection, degeneracy, equations of the structure). Formation and evolution, radii. Atmospheres (irradiation, stratospheres, heat redistribution, chemistry and composition, dust...). Brown dwarfs (definitions, observations, properties, spectral classification MLTY, formation, disks, interior, evolution, atmospheres).

Recommended literature:
Cassen et al. 2006, Extrasolar planets
Perryman 2011, The Exoplanet Handbook
Seager 2010, Exoplanets
Selected papers from journals

Languages necessary to complete the course:
Slovak / English

Notes:
Spoken language of the presentation is Slovak, however, slides and pictures are in English (to become familiar with proper English terms). If possible, one guest lecture from a foreign expert in the field in English. In case of interest, excursion to Astronomical Institute of the Slovak Academy of Sciences in Tatranska Lomnica.

Past grade distribution
Total number of evaluated students: 36

A	B	C	D	E	FX
80,56	19,44	0,0	0,0	0,0	0,0

Lecturers: RNDr. Ján Budaj, CSc.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-141/22	Selected Topics in History of Astronomy

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:

Antirequisites: FMFI.KAFZM/2-FAA-141/00

Course requirements:
Continuous Assessment : home assignments (50 points), presentation (50 points)
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
Origin of astronomy; Astronomy of ancient cultures; Astronomy of Greek philosofers: Aristarchos, Hipparchos; Almagest; Ptolemaios and the geocentric conception of the world; Astronomy in the middle ages; Copernicus and the heliocentric system; Gaileo Galilei; Kepler; Newton and development of celestial mechanics. Development of astrophysics.

Recommended literature:
Horský, Z., Plavec, M.: Poznávání vesmíru, Orbis, Praha 1962
Grygar, J., Horský, Z., Mayer, P.: Vesmír, Praha 1983
Pereľ: Vývin predstáv o vesmíre, Osveta, Bratislava 1969

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 0

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

Lecturers: doc. RNDr. Juraj Tóth, PhD.

Last change: 21.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-120/00	Seminar on Astronomy and Astrophysics (1)

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

Number of credits: 2

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment (100%): presentation and discussion participation
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Continuous Assessment / Final Examination: 100/0
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students will gain experiences with the preparation and oral presentation of their scientific work and with active participation in the discussion. Students will deepen their knowledge of the research fields covered at the seminar presentations.

Class syllabus:
Student's own scientific work, preparation of background materials and presentation of partial results of the diploma thesis. Active participation in the discussion. Presentation of current results of research programs by the staff of the Division of Astronomy and Astrophysics and invited speakers.

Recommended literature:
Proceedings from the IAU symposia and conferences
Astronomical journals

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 57

A	B	C	D	E	FX
96,49	3,51	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Leonard Kornoš, PhD., RNDr. Roman Nagy, PhD.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-121/00	Seminar on Astronomy and Astrophysics (2)

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

Number of credits: 2

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment (100%): presentation and discussion participation
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Continuous Assessment / Final Examination: 100/0
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students will gain experiences with the preparation and oral presentation of their scientific work and with active participation in the discussion. Students will deepen their knowledge of the research fields covered at the seminar presentations.

Class syllabus:
Student's own scientific work, preparation of background materials and presentation of partial results of the diploma thesis. Active participation in the discussion. Presentation of current results of research programs by the staff of the Division of Astronomy and Astrophysics and invited speakers.

Recommended literature:
Proceedings from the IAU symposia and conferences
Astronomical journals

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 58

A	B	C	D	E	FX
96,55	0,0	3,45	0,0	0,0	0,0

Lecturers: doc. RNDr. Leonard Kornoš, PhD., RNDr. Roman Nagy, PhD.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-220/22	Seminar on Astronomy and Astrophysics (3)

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

Number of credits: 2

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment (100%): presentation and discussion participation
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Continuous Assessment / Final Examination: 100/0
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students will gain experiences with the preparation and oral presentation of their scientific work and with active participation in the discussion. Students will deepen their knowledge of the research fields covered at the seminar presentations.

Class syllabus:
Student's own scientific work, preparation of background materials and presentation of partial results of the diploma thesis. Active participation in the discussion. Presentation of current results of research programs by the staff of the Division of Astronomy and Astrophysics and invited speakers.

Recommended literature:
Proceedings from the IAU symposia and conferences
Astronomical journals

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 54

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

Lecturers: doc. RNDr. Leonard Kornoš, PhD., RNDr. Roman Nagy, PhD.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-221/00	Seminar on Astronomy and Astrophysics (4)

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

Number of credits: 3

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment (100%): presentation and discussion participation
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Continuous Assessment / Final Examination: 100/0
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students will gain experiences with the preparation and oral presentation of their scientific work and with active participation in the discussion. Students will deepen their knowledge of the research fields covered at the seminar presentations.

Class syllabus:
Student's own scientific work, preparation of background materials and presentation of partial results of the diploma thesis. Active participation in the discussion. Presentation of current results of research programs by the staff of the Division of Astronomy and Astrophysics and invited speakers.

Recommended literature:
Proceedings from the IAU symposia and conferences
Astronomical journals

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 56

A	B	C	D	E	FX
96,43	1,79	0,0	1,79	0,0	0,0

Lecturers: doc. RNDr. Leonard Kornoš, PhD., RNDr. Roman Nagy, PhD.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., 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. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., II., III.

Prerequisites:

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

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

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

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

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 32

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

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: I., II., III.

Prerequisites:

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

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

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

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

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 25

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

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-201/15	Solar Physics

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: 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment : home assignments (10 points), test (10 points)
Final Examination : oral exam
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
Gain knowledge about the physics of the Sun and the physical processes of energy formation and transfer.

Class syllabus:
Basic definitions and assumptions, basic physical facts about the Sun. Internal structure of the Sun, energy production, energy transfer by radiation and convection. The solar neutrinos problem. Helioseismology. Solar atmosphere. Photospheric radiation, radiative transfer in the photosphere, Fraunhofer spectral lines, photospheric structures. Chromosphere. Transition region and corona, optically thin radiation, solar flares, coronal mass ejections. Solar activity and its cycle, solar wind, solar-terrestrial connection, space weather. Magnetic fields in the solar atmosphere, measurements of the magnetic field strength, Stokes parameters. Solar dynamics, differential rotation and its description.

Recommended literature:

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 40

A	B	C	D	E	FX
77,5	15,0	7,5	0,0	0,0	0,0

Lecturers: Mgr. Peter Gömöry, PhD., doc. RNDr. Leonard Kornoš, PhD.

Last change: 21.06.2022
Approved by: prof. Ing. Pavel Mach, CSc.

STATE EXAM DESCRIPTION

Academic year: 2024/2025	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAFZM/2-FAA-958/15	**Course title:** Solar Physics
Number of credits: 2	
Educational level: II.	
Learning outcomes: Students will demonstrate knowledge and ability to physically describe the interior and atmosphere of the Sun.	
Class syllabus: Basic definitions and assumptions, basic physical facts about the Sun. Internal structure of the Sun, energy production, energy transfer by radiation and convection. The solar neutrinos problem. Helioseismology. Solar atmosphere. Photospheric radiation, radiative transfer in the photosphere, Fraunhofer spectral lines, photospheric structures. Chromosphere. Transition region and corona, optically thin radiation, solar flares, coronal mass ejections. Solar activity and its cycle, solar wind, solar-terrestrial connection, space weather. Magnetic fields in the solar atmosphere, measurements of the magnetic field strength, Stokes parameters. Solar dynamics, differential rotation and its description.	
State exam syllabus:	
Last change: 31.01.2022	
Approved by: prof. Ing. Pavel Mach, CSc.	

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-147/00	Spectroscopy in Astronomy

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

Number of credits: 3

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment: homework assignment.
Final Examination: oral exam.
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
Gaining a basic overview of the energy states of atoms and molecules, their spectral characteristics, quantum-chemical description of rotational and vibrational motions, basic types of molecular spectroscopy, selection rules, their origin. To provide an overview of methods and applications of spectroscopic research in astronomy.

Class syllabus:
Hartree-Fock theory of atom and molecule. Atomic and molecular orbitals. Energy levels of atoms and molecules. Born - Oppenheimer approximation. Rotational and vibrational states of diatomic molecules. Rotational levels of polyatomic molecules. Vibration of polyatomic molecules. Electron states and electron spectra. atoms and molecules Symmetry of transitions, selection rules. Spin-orbital coupling. Summary of quantum mechanical theory of rotational moment. Spectroscopic methods in astronomy, modeling of synthetic spectra and fitting methods. Emission, absorption and reflectance spectroscopy in stellar, galactic and interplanetary astronomy.

Recommended literature:
Fyzikálna chémia : Časť 2b : Štruktúra / Peter W. Atkins. Bratislava : Slovenská technická univerzita, 1999
Molecular quantum mechanics / Peter Atkins, Ronald Friedman. Oxford : Oxford University Press, 2005
Exploring Chemistry with Electronic Structure Methods / James B. Foresman, AEleen Frisch. Gaussian, Inc, 1993, 1995-96, 2015
Tennyson J., 2005, Astronomical Spectroscopy: An Introduction To The Atomic And Molecular Physics Of Astronomical Spectra, Imperial College Press, ISBN 9781860945137

Appenzeller I., 2013, Introduction to Astronomical Spectroscopy, Cambridge University Press, ISBN 9781107601796

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 13

A	B	C	D	E	FX
61,54	15,38	15,38	7,69	0,0	0,0

Lecturers: prof. Ing. Pavel Mach, CSc., RNDr. Pavol Matlovič, PhD.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: 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, Mgr. Branislav Nedbálek, PhD.

Last change: 16.06.2022
Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

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.

Educational level: 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, Mgr. Branislav Nedbálek, PhD.
Last change: 16.06.2022
Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-101/22	Theoretical Astrophysics (1)

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

Number of credits: 7

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment (20%): home assignments 20points; min 12 points
Final Examination (80%): test 60 points, oral exam 10points, presentation 10points
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Continuous Assessment / Final Examination: 20/80
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
Understanding the basics of radiation transfer in stellar atmospheres.

Class syllabus:
Introduction (blackbody radiation, Stefan-Boltzmann law, specific intensity, flux, K-integral), Absorption and emission coefficient, Source function, Transfer equation (plane-parallel approximation, integral of flux, mean intensity and K-integral), Radiative equilibrium and Milne equations, Grey atmosphere (Eddington and Chandrasekhar solutions), Continuum absorption coefficient (absorption coefficients of hydrogen and helium, total absorption coefficient), Model atmosphere (hydrostatic equilibrium, temperature distribution, limb darkening, dependence on pressure and chemical composition), Line absorption coefficient (natural broadening, thermal broadening, pressure broadening, convolution, Fourier transformation, Voigt profile), Behavior of spectral lines (source function, profile), Chemical analysis and the line transfer equation, Stellar rotation, Turbulence in stellar atmospheres.

Recommended literature:
LeBlanc, F. (2010) An Introduction to Stellar Astrophysics, Wiley
Gray, D. F. (1992) The Observation and Analysis of Stellar Photospheres, Cambridge University Press
Mihalas, D. (1978) Stellar Atmospheres, W. H. Freeman

Languages necessary to complete the course:
slovak, english

Notes:

Past grade distribution
Total number of evaluated students: 7

A	B	C	D	E	FX
28,57	28,57	28,57	14,29	0,0	0,0

Lecturers: RNDr. Roman Nagy, PhD., doc. RNDr. Jozef Klačka, PhD.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-102/22	Theoretical Astrophysics (2)

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

Number of credits: 7

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment (20%): home assignments 20points; min 12 points
Final Examination (80%): test 60 points, oral exam 10points, presentation 10points
Approximate scale of final grades: A 91%, B 81%, C 71%, D 61%, E 51%
Continuous Assessment / Final Examination: 20/80
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
Understanding the basics of the theory of stellar structure and evolution.

Class syllabus:
Introduction (definition of a star, HR diagram), Sources of stellar energy, Time scales, Conservation laws, The equations of stellar evolution, Properties of matter and energy transport (equation of state, electron degeneracy pressure, radiation pressure, adiabatic index, radiative transfer), Nuclear reactions (pp chain, CNO cycle, burning of He and heavy elements, s-process, r-process), Nuclear reaction rates and Gamow peak, Equilibrium stellar configurations (equations of stellar structure, polytrope, Chandrasekhar limit, Eddington luminosity), The stability of stars (thermal instability in degenerate gas, thin shell instability, dynamic instability, convection), Stellar evolution in rho-T diagram, An evolution of the stellar core and a structure of the star, The pre-main-sequence phase in HR diagram (protocloud, Jeans instability, fragmentation, Hayashi track), Stellar evolution on the main sequence (lower and upper part of the main sequence, Schönberg–Chandrasekhar limit), Evolution away from main-sequence in HR diagram (Hertzsprung gap, red giants, helium flash, helium core burning, AGB stars), Final stages of stellar evolution (white dwarfs, supernovae, neutron stars, black holes).

Recommended literature:
Prialnik, D. (2009) An Introduction to the Theory of Stellar Structure and Evolution, Cambridge University Press, 2nd edition
LeBlanc, F. (2010) An Introduction to Stellar Astrophysics, Wiley

Languages necessary to complete the course:
slovak, english

Notes:

Past grade distribution
Total number of evaluated students: 62

A	B	C	D	E	FX
48,39	24,19	11,29	12,9	1,61	1,61

Lecturers: RNDr. Roman Nagy, PhD., doc. RNDr. Jozef Klačka, PhD.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.

COURSE DESCRIPTION

Academic year: 2024/2025

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/2-FAA-241/00	Variable Stars

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: 4.

Educational level: II.

Prerequisites:

Course requirements:
Continuous Assessment : home assignments
Approximate scale of final grades: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Get acquainted with essential knowledge of variable stars classification and methods of their observations.

Class syllabus:
Definition of variability. Physical and geometrical variable stars. Pulsating and chemically peculiar stars. T Tauri stars Solar-type variability, pulsars. Binary stars (visual, spectroscopic, eclipsing, polarimetric). Roche model of close binary stars. Proximity effects in close binaries. Rossiter McLaughlin rotational effect. Mass loss and transfer. Secular effects (apsidal motion, circularization and synchronization of the orbit) Symbiotic stars. Cataclysmic variables. Supernovae. Mass accretion and accretion disks. Evolution of binary stars. Observational techniques of the stellar astronomy (photometry, spectroscopy, polarimetry, interferometry). Introduction to the photometric and spectroscopic data reduction. Time-series analysis, period analysis and the method of (O-C) diagrams.

Recommended literature:
Zdeňek Mikulášek: Proměnné hvězdy – Skripta. Prírodovedecká fakulta Masarykovy univerzity v Brne, Brno 2002

Languages necessary to complete the course:
Slovak / English

Notes:

Past grade distribution
Total number of evaluated students: 19

A	B	C	D	E	FX
73,68	26,32	0,0	0,0	0,0	0,0

Lecturers: RNDr. Theodor Pribulla, CSc.

Last change: 20.06.2022

Approved by: prof. Ing. Pavel Mach, CSc.