Course descriptions

TABLE OF CONTENTS

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KJFB/1-UFY-241/10	Atomic and Nuclear Physics

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 3 / 1 **per level/semester:** 42 / 14
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 4.

Educational level: I., I.II.

Prerequisites:

Course requirements:
Continuous assessment: presentation of homework results (3x10 marks)
Exam: written (40 marks), oral (30 marks)
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Credits will be awarded if the student obtains at least 50% points.

Learning outcomes:
Graduates have a basic knowledge of Atomic and Nuclear Physics at the level of a core university course in general physics. They know how to use the concepts and methods of atomic and nuclear physics in solving problem situations. They have an idea of the boundaries between high school and university physics in the field of nuclear and nuclear in terms of work with high school youth with an increased interest in physics.

Class syllabus:
Photoelectric effect, Compton effect, Rutherford experiment, Bohr model, timeless Schrödinger equation, structure of atoms and molecules, basic properties of nuclei, structure of nuclei, transformation of nuclei, nuclear reactions, nuclear power plant, particle accelerators.

Recommended literature:
Fyzika část 5. Moderní fyzika : Vysokoškolská učebnice obecné fyziky / David Halliday, Robert Resnick, Jearl Walker ; přeložili Bohumila Lencová ... [et al.]. Brno : Vysoké učení technické VUTIUM, 2000
Všeobecná fyzika : 4 : atómová fyzika / Ján Vanovič. Bratislava : Alfa, 1980
Physics : principles with applications / Douglas C. Giancoli. Upper Saddle River, N.J. : Pearson/ Prentice Hall, 2005
Own electronic texts of the subject published through the course website.

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution Total number of evaluated students: 195					
A	B	C	D	E	FX
21,54	17,95	18,97	16,92	21,54	3,08
Lecturers: doc. RNDr. Radoslav Böhm, PhD., Ing. Jakub Kaizer, PhD.					
Last change: 18.06.2022					
Approved by: prof. Mgr. Michal Chabada, PhD.					

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-160/15	Calculus for Physics Teachers

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1.

Educational level: I.

Prerequisites:

Course requirements:
Continuous assessment: solving problems (3x10 marks), homeworks (3x10 marks), tests (2x20 marks)
Indicative rating scale: A 90%, B 80%, C 70%, D 60%, E 50%.
Credits will not be awarded if a student scores less than 50%.

Learning outcomes:
By completing the course, students will expand and supplement their knowledge of selected parts of mathematics and can use them in solving physics problems.

Class syllabus:
Matrices, determinants. linear combination of vectors. Trigonometric functions and their graphs, trigonometric equations. Equation of the tangent. Function limit. Indefinite integral, decomposition into partial fractions, improper integral. Complex numbers, properties and operations. Algebraic, trigonometric and exponential form of complex numbers.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 91

A	B	C	D	E	FX
56,04	19,78	6,59	6,59	5,49	5,49

Lecturers: doc. PaedDr. Klára Velmovská, PhD., Mgr. Aneta Kolodzejová

Last change: 18.06.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-181/15	Complementary Exercises in Mechanics

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1.

Educational level: I.

Prerequisites:

Course requirements:
A series of written exams during the semester (5x20 marks).
Credits will not be awarded if the student obtains less than 50% of marks even after repeated assignments.

Learning outcomes:
After completing the course, the student will be able to independently solve computational problems at a level slightly higher than the level of a secondary school graduate in physics.

Class syllabus:
The exercise is a support for the subject Mechanics, the syllabus is in accordance with the syllabus of the subject Mechanics.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 103

A	B	C	D	E	FX
94,17	1,94	0,97	1,94	0,0	0,97

Lecturers: PaedDr. Peter Horváth, PhD.

Last change: 18.06.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-338/22	Computer Models and Animations for Teachers

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 6.

Educational level: I.

Prerequisites:

Course requirements:
During the semester, there will be two written examinations, from which the student can obtain max. 2x 20 points. In the middle of the semester, the student submits a plan of semester work - max. 10 points. At the end of the semester, the student submits a semester work - max. 30 points. During the exam period, there will be a discussion, where the student can get max. 20 points. Credits will not be awarded if a student scores less than 50%.

Learning outcomes:
The content of the course follows the lecture on molecular physics and thermodynamics. In addition, it relies on the knowledge gained in the subject of Atomic and Nuclear Physics. It complements and deepens the knowledge and skills acquired at the Digital Technology course. Students will get acquainted with several models, thanks to which we can illustrate the events taking place at the level of the microworld. They personally test the models in a specific application for teaching physics. Graduates of the course will be able to not only use the models, but also adapt them to the requirements of their own pedagogical practice. They will also gain a useful basis for independent modeling of molecular physics, thermodynamics and atomic / nuclear physics. They will be able to work with computer models and animations, they will be able to meaningfully combine them with simple tools and mechanical models.

Class syllabus:
Mechanical analogies in molecular physics and thermodynamics. Modelling of properties of gaseous, liquid and solid substances. Magnetic-mechanical model of processes in gases. Computer models and applets freely available on the Internet. Design of simple computer models. Models and simulations in a computer-assisted science laboratory.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 2

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

Lecturers: PaedDr. Lukáš Bartošovič, PhD.

Last change: 18.06.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-336/22	Design of Texts and Tasks for Science Education

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 6.

Educational level: I.

Prerequisites:

Course requirements:
In the middle of the semester, the student submits a plan of semester work - max. 10 marks. At the end of the semester, the student submits a semester work - max. 20 marks. Defence of the semester work is for 10 marks. In the exam period, there will be a structured discussion, where the student can get max. 10 marks. Credits will not be awarded if the student scores less than 50% of the marks.

Learning outcomes:
The student knows the selected principles of creating textbook materials and can use these principles when writing a chapter to a textbook and a text to a popular science journal.

Class syllabus:
Phases of the intended curriculum (Bain Idea, content goals, directional questions, standards). Modeling the student's input knowledge and experience. Selection of contexts for use in texts. Scene for learning. Problem situations and tasks for qualitative solution estimation, strategies for solving physics problems by novices and experts, problem tasks, complex tasks, tasks aimed at concept understanding. Formulation of teaching text. Analysis of the created text. Verification of the text on a model student.

Recommended literature:
Held Ľ. a kol, (2016). Východiská prípravy prírodovedného kurikula pre základnú školu 2020 II
Harlen, W. (2015). Working with Big Ideas of Science Education. Trieste: Science Education Programme of IAP.
Klentschy, M., & Thompson, L. (2008). Scaffolding Science Inquiry Through Lesson Design. Heinemann.
Demkanin, P. (2018) Didaktika fyziky
Course material

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 7

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

Lecturers: doc. RNDr. Peter Demkanin, PhD.

Last change: 18.06.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-311/22	Educational Games

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 5.

Educational level: I.

Prerequisites:

Course requirements:
During the semester, students prepare a written semester work. Project of the work (10 marks), preliminary work (20 marks), final version (30 marks), defence (20 marks), discussion on the work of peers (20 marks).
Rating A = (90, 100]%, B = (80, 90]%, C = (70, 80]%, D: (60, 70]%, E: (50, 60]%).
Credits will not be awarded if a student scores less than 50%.

Learning outcomes:
The student will gain basic knowledge about the specifics of teaching physics in the outdoor environment. At a level appropriate to the future beginning physics teacher, will know the main characteristics of non-formal education and will be able to use selected methods of non-formal education in teaching physics in primary and secondary schools.

Class syllabus:
Game, its role in the life of an individual of different ages. The importance of the game for the development of cognitive skills. Game features in education. Didactic and educational game. Spontaneous and directed game. Types and functions of questions. Stages of creating an educational game - goal, choice of context, ideological intention, rules of the game, creation of tasks, basis for evaluation discussion. Game testing. Teacher functions, pedagogical intervention during the educational game. Evaluation of the success of the educational game.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 14

A	B	C	D	E	FX
85,71	7,14	7,14	0,0	0,0	0,0

Lecturers: doc. PaedDr. Viera Haverlíková, PhD.
Last change: 18.06.2022
Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KTF+KDMFI/1-UFY-141/15	Electromagnetism

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 3 / 2 **per level/semester:** 42 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: I.

Prerequisites:

Course requirements:
Continuous assessment: written tests, homework
Exam: oral, written
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Credits will be awarded if the student obtains at least 50% marks.

Learning outcomes:
Students have knowledge of electricity and magnetism at the level of the core course of university physics. They will master the basic calculation methods and procedures for solving physics problems in electromagnetism. They will understand the boundaries between secondary school physics and university physics in the field of electricity and magnetism in terms of working with high school youth with an increased interest in physics.

Class syllabus:
Electric charge. Coulomb's law. Electric field. Gauss's law. Electric potential. Capacity. Electric current and resistance. Circuits. Magnetic field. Magnetic field of electric current. Electromagnetic induction. Magnetic field in matter. Maxwell's equations. Electromagnetic oscillations. Alternating currents. Electromagnetic waves.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 93

A	B	C	D	E	FX
21,51	7,53	22,58	16,13	22,58	9,68

Lecturers: RNDr. Eduard Masár, PhD., doc. RNDr. Peter Demkanin, PhD.

Last change: 18.06.2022
Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-310/15	Introduction to Didactics of Physics

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 5.

Educational level: I., N

Prerequisites: FMFI.KDMFI/1-UFY-232/22 - School Physics (1)

Course requirements:
Continuous assessment: presentation of the results of individual work (2x25 marks)
Exam: written (20 marks), oral (30 marks)
Indicative rating scale: A 90%, B 80%, C 70%, D 60%, E 50%.
Credits will not be awarded if a student scores less than 50%.

Learning outcomes:
The graduate will know the relationship between pedagogy, psychology and physics didactics. Graduates - future physics teachers will understand the basic goals, methods and means of physics education.

Class syllabus:
Didactics of physics as applied science. Current goals and problems of physical education. Teaching strategies. Cognition methods. Models and modelling in physics teaching. The empirical and theoretical approach to knowledge mediation. Means of teaching physics. Experiment. Mathematical procedures. Coordinate graph function. Solving physics problems. Microcomputer supported and multimedia lab. Possibilities of influencing students' motivation by teachers. Preparation for teaching. Evaluation of students' knowledge.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 80

A	B	C	D	E	FX
61,25	15,0	12,5	6,25	2,5	2,5

Lecturers: doc. PaedDr. Klára Velmovská, PhD.

Last change: 18.06.2022
Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-220/15	Introduction to School Experiments

Educational activities:
Type of activities: lecture / laboratory practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 3.

Educational level: I., N

Prerequisites:

Course requirements:
Continuous assessment: written test (10 marks), individual work projects (2x20 marks), practical test (10 marks)
Exam: oral (40 marks)
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Credits will be awarded if the student obtains at least 50% marks.

Learning outcomes:
Graduates have the knowledge, skills and abilities necessary for the methodology and technique of performing several types of school physical measurements and experiments in the physics curriculum of lower secondary and high schools.

Class syllabus:
Phases of a school experiment, types of school experiments, measurements and observations, possibilities of a computer-aided science laboratory, measurement with sensors, basics of video measurement, basics of preparation of interactive animations. Preparation of instruction for a student for an experiment planned by a teacher, preparation and assignment of a student planning experiment. Empirical cognition in school physics, basics of measuring results, student work in empirical cognition.

Recommended literature:
Evidence based teaching : A practical approach / Geoff Petty. Cheltenham : Nelson Thornes, 2006
Počítačom podporované prírodovedné laboratórium / Peter Demkanin a kol.. Bratislava : Knižničné a edičné centrum, 2006
Demkanin, P, Didaktika fyziky, UK 2018
Klentschy, Michael P.: Scaffolding Science Inquiry Through Lesson Design
Own electronic texts of the subject published through the subject's website.

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 102

A	B	C	D	E	FX
56,86	22,55	13,73	0,98	2,94	2,94

Lecturers: doc. RNDr. Peter Demkanin, PhD.

Last change: 18.06.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-120/15	Mathematical Methods in Physics (1)

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 1 **per level/semester:** 28 / 14
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 1.

Educational level: I.

Prerequisites:

Course requirements:
Continuous assessment: written exams, problem solving
Exam: written
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Credits will be awarded if the student obtains min. 50% marks.

Learning outcomes:
Students know the basic mathematical concepts and methods used in the physics course. These can be used in solving basic physics course tasks.

Class syllabus:
Vector and basic vector operations. Scalar and vector product. Function and its properties. Derivation of a function. The course of the function. Differential. Taylor polynomial. Application of differential calculus. Indefinite integral. Integration methods. Definite integral. Applications of a definite integral. Improper integral. 1st and 2nd order linear differential equations. 1st order and 2nd order differential equations. Differential equations in physics.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 108

A	B	C	D	E	FX
48,15	21,3	8,33	5,56	5,56	11,11

Lecturers: doc. PaedDr. Klára Velmovská, PhD.

Last change: 18.06.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-121/15	Mathematical Methods in Physics (2)

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2.

Educational level: I.

Prerequisites:

Course requirements:
Continuous assessment: tests (3x20 marks), problem solving (4x10 marks)
Indicative rating scale: A 90%, B 80%, C 70%, D 60%, E 50%.
Credits will be awarded if the student obtains min. 50% marks.

Learning outcomes:
Graduates master selected mathematical concepts and methods used in physics and know how to use them in solving core physics courses.

Class syllabus:
Real function of several variables. Points and sets in n-dimensional space. Limit functions of several variables. Continuity of a function of several variables. Partial derivatives of functions of several variables. Complete differential of a function of several variables. Taylor polynomial functions of several variables. Extremes of functions of several variables. Local extremes of functions of several variables. Bound local extremes. Global (absolute) extremes. Integral of functions of several variables. Calculation of a certain integral on an interval. Integral calculation on the elementary domain. Substitution method for integrals of several variables (polar, cylindrical and spherical coordinates). Geometric applications of integral of several variables. Applications of plural integrals in physics. Scalar and vector fields. Gradient, divergence, rotation. Curve integrals of the 1st and 2nd kind.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 82

A	B	C	D	E	FX
59,76	15,85	9,76	9,76	1,22	3,66

Lecturers: doc. PaedDr. Klára Velmovská, PhD.
Last change: 18.06.2022
Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-111/15	Mechanics

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 3 / 2 **per level/semester:** 42 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: I.

Prerequisites:

Course requirements:
Continuous assessment: papers. homeworks
Exam: written
Indicative rating scale: A 90%, B 80%, C 70%, D 60%, E 50%.
Credits will not be awarded if a student scores less than 50%.

Learning outcomes:
Students will understand the basic concepts and laws of mechanics and will be able to use them in solving problems.

Class syllabus:
Basic physical quantities. Gradual movement, movement in a circle. Newton's laws of dynamics, force, momentum. Inertial and non-inertial reference frames. Gravitational field. Work, kinetic and potential energy, moment of force, moment of momentum. Conservation laws in mechanics. Rigid body mechanics, center of gravity, moment of inertia, Steiner's theorem, rotational motion. Fluid mechanics. Oscillations - free, damped and forced, resonance.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 117

A	B	C	D	E	FX
28,21	18,8	17,95	14,53	5,13	15,38

Lecturers: PaedDr. Peter Horváth, PhD., doc. RNDr. Peter Demkanin, PhD.

Last change: 18.06.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-342/15	Molecular Physics and Thermodynamics

Educational activities:
Type of activities: lecture
Number of hours:
per week: 3 **per level/semester:** 42
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 2.

Educational level: I.

Prerequisites:

Course requirements:
Continuous assessment: tests (2x10 marks), presentation of individual project work (10 marks), homeworks (3x10 marks)
Exam: written (40 marks)
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Credits will not be awarded if a student scores less than 50%.

Learning outcomes:
Graduates will have basic knowledge of molecular physics and thermodynamics - basic concepts, methods, laws and selected applications in this field. They will have an idea of the boundaries between graduation and university physics in this area in terms of working with high school youth with an increased interest in physics. They will have developed skills and knowledge to work with energy transformations and the law of conservation of energy within classical physics.

Class syllabus:
History of molecular discovery, Mol, Avogadro's constant, typical dimensions of the microworld. Phenomenology of gas processes, equation of state, Kelvin scale. Kinetic theory of gas pressure, the relationship between temperature, heat and energy. Macroscopic work of gas, heat as microscopic work, the first thermodynamic theorem. Mayer's relationship, Adiabatic story. Continuous random variables. Maxwell's velocity distribution. Boltzmann distribution and barometric formula. A synthesizing view of the law of conservation of energy in classical physics.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution Total number of evaluated students: 80					
A	B	C	D	E	FX
68,75	17,5	5,0	2,5	1,25	5,0
Lecturers: PaedDr. Lukáš Bartošovič, PhD.					
Last change: 18.06.2022					
Approved by: prof. Mgr. Michal Chabada, PhD.					

STATE EXAM DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty: Faculty of Arts	
Course ID: FMFI.KDMFI/1-UFY-951/15	**Course title:** Physics and Didactics of Physics
Number of credits: 2	
Educational level: I.	

Course requirements:

The final examination is realized by the student's discussion with the members of the commission on two topics from the content of the examination. Assessed: illustration of concepts on suitable examples / contexts / situations 0-3 points; correctness of physics terminology 0-3 points; intelligibility of discussion 0-3 points; responding to commission questions regarding selected topics 0-3 points; responding to other commission questions / broader context 0-3 points. Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%

The exam is successfully passed if the student obtains at least 50% of points.

Learning outcomes:

Passing the exam represents fulfilling the profile of the graduate.

Class syllabus:

Physics:

Movement in two dimensions. Even movement in a circle. Movements in a homogeneous gravitational field, oblique litter. Newton's laws of motion. Relationship between free fall and motion of bodies in the radial field of the Earth.

Mechanical work, kinetic energy, work of gravitational force (in homogeneous gravitational field), work of elastic force, power, potential gravitational energy, potential energy of elasticity, law of conservation of mechanical energy, conservative and non-conservative forces, work of friction force.

Fluid mechanics, pressure, compressive force, pressure induced by fluid gravity, Archimedes' law, Pascal's law, continuity equation, Bernoulli's equation.

Elastic and inelastic collisions, momentum, impulse of force, law of conservation of system momentum, elastic and inelastic direct collisions, oblique collisions, explosion (in two parts).

Moment of force with respect to the axis of rotation, momentum of the moment for rotation around a fixed axis (second impulse theorem), rolling, rotation of bodies around a fixed axis, rolling on an inclined plane. Momentum, momentum of a particle system, momentum of a rigid body with respect to a fixed axis, the law of conservation of momentum.

Coulomb's law. Electric field. Scalar and vector fields. Electric fields, lines of force. Point charge field. Superposition of electric fields. Electric dipole field. Application of Gauss' s law.

Electric potential. Electric potential energy. Potential, voltage, equipotential surfaces. Electron volt. Work performed by an external force when moving the charge in the el. field. Point charge potential. Potential energy and potential of a system of point charges. Faraday's cage. Capacity. Capacitor and capacity. Capacitor charging process.

Circuits with unidirectional el. current. Electromotive voltage. Internal battery resistance, terminal voltage. Battery power, power dissipation, battery charging and discharging. Loop rule, node rule, current calculation in resistor circuits by voltage method. Serial and parallel connection of resistors. Connection of ammeters and voltmeters, ideal ammeter and ideal voltmeter.

Magnetic field. The essence of magnetism and the magnetic field, the absence of a magnetic monopole. Magnetic induction, Lorentz force. Induction lines. Bar magnet. The trajectory of a charged particle in mag. field. Earth's magnetic field, aurora borealis. Cyclotron and synchrotron. Charged particle separator according to velocities, mass spectrometer. Hall map. Force acting on a current conductor in a magnetic field (Ampere's force).
Electromagnetic induction. Induced current, induced electromotive voltage. Experiments demonstrating electromagnetic induction. Faraday's law of electromagnetic induction. Lenz's law. Induction energy transfer. Alternator. Faraday's law of electromagnetic induction in integral form. Eddy currents.
Electromagnetic oscillations and alternating current circuits. LC oscillations, energy transfer, energy conservation, mechanical analogy. Damped oscillations in a serial RLC circuit. Circular frequency of undamped and damped oscillations. Power in RLC circuit with AC source. Effective voltage, power factor, resonant frequency of the source.
Mechanical vibration, kinematics - instantaneous deflection, speed and acceleration of oscillating motion, equation of motion for harmonic motion, energy of harmonic oscillator. Torsional oscillations, mathematical and physical pendulum, damped and forced oscillations, resonance.
Waves, superposition principle, wave speed propagating on a rope, reflection and transmission of a wave at an interface, standing waves, sound, resonance in tubes, Doppler effect, sound shock waves. Doppler phenomenon in connection with sound and in connection with light. Body velocity measurement. Infrared shift when exploring distant stars.
Electromagnetic waves, light, spectral regions of light and electromagnetic waves, Interference in space, basic assumptions of two-beam interference, Young's two-slit experiment, intensity profile in interference, interference on thin films. Sound wave interference. Bending (diffraction) of light at the aperture, Rayleigh criterion, diffraction grating.
Rutherford scattering, Bohr model of the atom, electron transitions between energy levels, emission and absorption spectra of gases. Franck-Hertz experiment. X-rays.
Interaction and radiation detection. Photoelectric effect, Compton scattering, pair formation and annihilation.
The nucleus of an atom and its properties. Weight loss and binding energy. nuclear fusion and fission. Isotopes.
Radioactive transformation. Alpha, beta and gamma radiation. Law of radioactive transformation, activity. Absorption characteristics of alpha, beta and gamma rays.
Ideas about the microworld. Basic substance characteristics (molar quantities). Equation of state of an ideal gas. Heat and temperature, Kelvin temperature scale. Thermal processes with an ideal gas - state changes and energy aspects. Ideal gas pressure, barometric equation. Kinetic theory of substance structure. Maxwell-Boltzmann distribution. The law of conservation of energy in terms of thermodynamics.
Didactics:
Science literacy, scientific work skills. Examples of the development of scientific skills in teaching physics.
Objectives and content of science and physical education.
Bloom's taxonomy of goals and its application in the creation of physical problems.
Basic pedagogical documents and teaching aids, their structure and function.
The model of ontogenesis of thinking according to J. Piaget and its importance for the creation of the physics curriculum.
Empirical and theoretical cognition in school physics. Selected methods of access to methods and ways of cognition.
Graphic method of communication between two quantities. Examples of the use of graphs in the introduction of some physical concepts.

Classification of physical tasks. The importance of the physical role in the cognitive process.
Complex physical problems, function of complex tasks in introducing ideas about natural phenomena.
Complete scheme of the school physics experiment planned by the teacher - the teacher's activity.
Pupil's activity in various phases of planning, implementation and data processing of a school physics experiment. Pupil-planned experiment.
Classification of school physics experiments (cognitive functions, organization, means used, data obtained).
Assessment and classification of students in physics teaching. Assessment of the degree of development of students' scientific abilities.
Key experiments on the topic of "fluid statics".
Key experiments on the topic of "calorimetry".
Key experiments on the topic of "molecular physics".
Key experiments on the topic of "movement and force".

State exam syllabus:

Recommended literature:
Recommended literature on the subjects of the study program.

Languages necessary to complete the course:
Slovak and English.

Last change: 10.03.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-360/15	Physics as the Component of Science Education

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 5.

Educational level: I.

Prerequisites:

Course requirements:
Continuous assessment: seminar work (30 marks), defence of seminar work (40 marks), discussion of the work of peers (30 marks)
Indicative rating scale: A 90%, B 80%, C 70%, D 60%, E 50%.
Credits will not be awarded if a student scores less than 50%.

Learning outcomes:
They will know the ways of integration of science subjects into didactic programs and the position of physics in them, common methods, procedures, strategies and concepts in science subjects.

Class syllabus:
New approaches to the transformation of natural sciences into didactic models of education. Physics as a basis of conceptual structure and methods of work in the didactic model of science education. Graphical method of imaging as a way of mathematical modeling of phenomena. Application of historical aspects in the content of education.
Investigation of the properties of liquids and gases - a starting point for mastering the methods of measuring weight, length, volume. Procedures and strategies for experimental activities, as well as processing of measured data. Application of selected methods of work in physics to the study of living organisms.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 53

A	B	C	D	E	FX
75,47	13,21	7,55	0,0	0,0	3,77

Lecturers: doc. PaedDr. Viera Haverlíková, PhD.

Last change: 18.06.2022
Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-170/20	Physics by Experience

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

Number of credits: 2

Recommended semester: 1., 3., 5.

Educational level: I.

Prerequisites:

Course requirements:
During the camp, students will solve short practical tasks (3x10 marks) and one project task (40 marks). Reflection of the camp activities is for max. 30 marks.
Rating A = (90, 100]%, B = (80, 90]%, C = (70, 80]%, D: (60, 70]%, E: (50, 60]%).
Credits will not be awarded if a student scores less than 50%.

Learning outcomes:
By completing the course, the student will gain basic knowledge about the specifics of teaching physics in the outdoor environment. At a level appropriate to the future beginning physics teacher, will know the main characteristics of non-formal education and will be able to use selected methods of non-formal education in teaching physics at secondary schools.

Class syllabus:
The outdoor environment as a part of the environment for elementary school students' learning. Formal, non - formal and informal learning. Edutainment. Situation analysis - condition analysis, environment analysis and needs analysis. Objectives of non-formal education - knowledge, skills, attitudes, relationships. Methods and techniques in non-formal education. Creative-discovery workshops. Educational games. Group dynamics.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 31

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

Lecturers: doc. PaedDr. Viera Haverlíková, PhD., doc. PaedDr. Klára Velmovská, PhD.

Last change: 18.06.2022
Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-320/15	School Experiments in Physics

Educational activities:
Type of activities: laboratory practicals
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 5.

Educational level: I., N

Prerequisites:

Course requirements:
Continuous assessment: tests (2x15 marks), assessment of individual work (2x15 marks)
Exam: practical (20 marks), written (20 marks)
Indicative rating scale: A 90%, B 80%, C 70%, D 60%, E 50%.
Credits will not be awarded if a student scores less than 50%.

Learning outcomes:
Students will gain an overview of selected experiments conducted at secondary school. They will be able to carry out the experiments independently, explain them from a physics point of view and include them appropriately in the process of physics and science education.

Class syllabus:
Safety in the school laboratory. Demonstration experiments, frontal, work of students in a group. Experiments on the properties of substances, fluid statics, calorimetry, molecular physics, fluid dynamics, statics and dynamics of a rigid body, work, power, energy, kinematics, motion and force.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 85

A	B	C	D	E	FX
51,76	23,53	17,65	2,35	3,53	1,18

Lecturers: doc. PaedDr. Klára Velmovská, PhD., Mgr. Aneta Kolodzejová, RNDr. Kristína Rostás, PhD.

Last change: 18.06.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-232/22	School Physics (1)

Educational activities:
Type of activities: lecture / laboratory practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 3.

Educational level: I.

Prerequisites:

Course requirements:
During the semester there will be two written examinations, each for max. 25 points. An oral exam will take place during the exam period (max. 50 points). The condition for registering for the oral exam is a success rate of more than 50% in the continuous evaluation. Final evaluation: A = (92, 100]%, B = (84, 92]%, C = (76, 84]%, D = (68, 76]%, E = (60, 68]%).
The condition for granting credits is the achievement of at least 60% marks.

Learning outcomes:
By completing the course, the student will gain an overview of the content of the topics mechanical waves and acoustics, electromagnetic waves and optics, atomic physics, nuclear physics and radioactivity in school physics. At a level appropriate to the future beginning physics teacher, he / she will know the key barriers of primary and secondary school students in learning about these areas of physics. The student will be able to think about teaching these topics in broader contexts.

Class syllabus:
Mechanical waves. Sound and ultrasound. Light and geometric optics. Wave properties of light. Electromagnetic radiation. Non - ionizing electromagnetic radiation. Ionizing electromagnetic radiation. Structure of matter, atoms and molecules. From classical to quantum physics. Atomic nucleus and radioactivity. Interaction of radioactive radiation with matter.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 31

A	B	C	D	E	FX
48,39	35,48	3,23	3,23	3,23	6,45

Lecturers: doc. PaedDr. Viera Haverlíková, PhD., PaedDr. Lukáš Bartošovič, PhD.

Last change: 18.06.2022
Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-233/22	School Physics (2)

Educational activities:
Type of activities: lecture / laboratory practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 4

Recommended semester: 6.

Educational level: I.

Prerequisites: FMFI.KDMFI/1-UFY-220/15 - Introduction to School Experiments or FMFI.KDMFI/1-UFY-120/15 - Mathematical Methods in Physics (1)

Course requirements:
During the semester, there will be two written examinations of 20 points each, protocols prepared by students will also be evaluated, for a total of 30 points. The final exam will consist of a practical check for 30 points. A, it is necessary to obtain at least 92 points, at least 84 points to obtain a B rating, at least 76 points to obtain a C rating, at least 68 points to obtain a D rating and at least 60 points to obtain an E rating. Credits will not be granted to a student who does not pass the final practical exam for at least 20 marks.

Learning outcomes:
Graduates of the course will have a systematic and confirmed knowledge of selected chapters of high school physics from the perspective of a physics teacher and a student of a basic university course (aware of the interconnectedness of high school and university physics); they will be aware of the usual misconceptions and simplifications related to high school physics. They will be able to design and implement an experiment related to the topic at the level of a teacher's assistant.

Class syllabus:
Systematization of higher secondary school physics. Detailed study of topics: Electrostatics, comparison of Coulomb's and Newton's law, homogeneous and radial electric fields. Direct current, Ohm's law, Kirchhoff's laws. Stationary and non-stationary magnetic fields. Particle motion in electric and magnetic fields. Electromagnetic induction, Faraday's law. AC circuits.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 10

A	B	C	D	E	FX
70,0	20,0	10,0	0,0	0,0	0,0

Lecturers: PaedDr. Peter Horváth, PhD.

Last change: 18.06.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-337/22	Selected Parts of Didactics of Physics for Secondary School Graduates

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 6.

Educational level: I.

Prerequisites: FMFI.KDMFI/1-UFY-220/15 - Introduction to School Experiments

Course requirements:
Continuous assessment: written tests (3x20 marks), homeworks (4x10 marks)
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Credits will be awarded if the student obtains at least 50% marks.

Learning outcomes:
The student knows the specifics of the didactics of preparing high school students for the graduation exam in physics.

Class syllabus:
Requirements for high school graduates in physics in the following areas: level of knowledge in physics, level of ability to apply their knowledge in solving complex problems, level of ability to apply their knowledge to formulate a research question that can be solved by physics experiment. Specifics of graduate training in the topics: mechanics, energy conservation, geometric and wave optics, atomic and nuclear physics. The use of exponential and logarithmic functions in the preparation of high school graduates in physics.

Recommended literature:

Languages necessary to complete the course:
Slovak and English.

Notes:

Past grade distribution
Total number of evaluated students: 4

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

Lecturers: PaedDr. Tünde Kozánek Kiss, PhD.

Last change: 18.06.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KDMFI/1-UFY-265/15	Unconventional Physics

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 6.

Educational level: I.

Prerequisites:

Course requirements:
Continuous assessment: active seminar work (40 marks), assessment of teaching-learning sequences (3x20 marks)
Indicative rating scale: A 90%, B 80%, C 70%, D 60%, E 50%.
Credits will not be awarded if a student scores less than 50%.

Learning outcomes:
The student will be able to apply physics in non-traditional, practical tasks and interesting life situations. He will get inspiration to lead a physics afternoon class at school.

Class syllabus:
Students will get acquainted with non-traditional approaches to the introduction and practice of selected physical concepts and laws from the curriculum of primary and secondary school through simple experiments, non-traditional tasks, home laboratory tasks, projects. They will get acquainted with the possibilities of using these approaches in non-formal and informal science education.

Recommended literature:

Languages necessary to complete the course:
Slovenský a anglický.

Notes:

Past grade distribution
Total number of evaluated students: 61

A	B	C	D	E	FX
96,72	1,64	0,0	0,0	0,0	1,64

Lecturers: doc. PaedDr. Klára Velmovská, PhD.

Last change: 18.06.2022

Approved by: prof. Mgr. Michal Chabada, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Arts

Course ID:	**Course title:**
FMFI.KEF/1-UFY-210/22	Waves and Optics

Educational activities:
Type of activities: lecture / course
Number of hours:
per week: 3 / 1 **per level/semester:** 42 / 14
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 4.

Educational level: I., I.II.

Prerequisites:

Course requirements:
Continuous assessment: written tests (2x10 marks), lab reports (2x15 marks)
Exam: written (30 marks), oral (20 marks)
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Credits will be awarded if the student obtains at least 50% marks.

Learning outcomes:
Graduates have a systematic knowledge of mechanical waves (including sound) and wave optics at the level of a core university physics course. They have an idea of the boundaries between graduation and university physics in the field of wave optics from the point of view of work with high school youth with an increased interest in physics.

Class syllabus:
Oscillations and oscillating systems (modes, resonators, oscillations and waves, Fourier analysis of oscillations). Waves (harmonic waves, complex notation, wave superposition, wave polarization, Doppler effect, wave diffraction, waves in physics, and waves at boundaries). Wave optics (light interference, light diffraction, holography, light dispersion in dielectrics, dispersion, polarization by reflection and refraction, spreading of light in anisotropic conditions). Geometrical optics and basics of optical projection. Photo metrics. Contemporary problems in optics.

Recommended literature:

Languages necessary to complete the course:
Slovak ad English.

Notes:

Past grade distribution
Total number of evaluated students: 156

A	B	C	D	E	FX
26,92	21,79	26,92	15,38	8,33	0,64

Lecturers: prof. RNDr. Pavel Veis, CSc.

Last change: 18.06.2022
Approved by: prof. Mgr. Michal Chabada, PhD.