Study plan

Name of study plan: Physical Engineering - Laser Technology and Photonics

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Physical Engineering
Type of study: Bachelor full-time
Required credits: 0
Elective courses credits: 180
Sum of credits in the plan: 180
Note on the plan:

Name of the block: Compulsory courses in the specialization
Minimal number of credits of the block: 0
The role of the block: PS

Code of the group: BSPFILTFAJ1
Name of the group: BS P_FIBA LTF 1st year
Requirement credits in the group: In this group you have to gain at least credits (at most 0)
Requirement courses in the group: In this group you have to complete at least 13 courses
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
02YDEF1	**History of Physics 1** *Igor Jex* ***Martin Štefaňák*** *Igor Jex (Gar.)*	Z	2	2+0	Z	PS
02YELMA	**Electricity and Magnetism** *Iskender Yalcinkaya, Goce Chadzitaskos* ***Goce Chadzitaskos*** *Goce Chadzitaskos (Gar.)*	Z,ZK	6	4+2	L	PS
01YLAL	**Linear Algebra 1** *Lubomíra Dvořáková, Petr Ambrož* ***Lubomíra Dvořáková*** *Lubomíra Dvořáková (Gar.)*	Z	2	2P+2C		PS
01YLALZ	**Linear Algebra 1, exam** *Lubomíra Dvořáková, Petr Ambrož* ***Lubomíra Dvořáková*** *Lubomíra Dvořáková (Gar.)*	ZK	2	0P+0C		PS
01YLAL2	**Linear Algebra 2** *Lubomíra Dvořáková, Petr Ambrož* ***Lubomíra Dvořáková*** *Lubomíra Dvořáková (Gar.)*	Z,ZK	4	2P+2C		PS
01YMAN	**Calculus 1** *Miroslav Kolář* ***Miroslav Kolář*** *Miroslav Kolář (Gar.)*	Z	4	4+4		PS
01YMANZ	**Calculus 1, exam** *Miroslav Kolář* ***Miroslav Kolář*** *Miroslav Kolář (Gar.)*	ZK	4	0P+0C		PS
01YMAN2	**Calculus 2** *Miroslav Kolář* ***Miroslav Kolář*** *Miroslav Kolář (Gar.)*	Z,ZK	8	4P+4C		PS
02YMECH	**Mechanics** *Iskender Yalcinkaya, David Břeň* ***Martin Štefaňák*** *David Břeň (Gar.)*	Z	4	4+2	Z	PS
02YMECHZ	**Mechanics - Examination** *Iskender Yalcinkaya, David Břeň* ***Martin Štefaňák*** *David Břeň (Gar.)*	ZK	2	-	Z	PS
00YPT	**Orientation Week** *Petr Ambrož, Andrii Anikushyn, Milan Krbálek* ***Petr Ambrož*** *Andrii Anikushyn (Gar.)*	Z	2	týden	Z	PS
02YTER	**Heat and Molecular Physics** *Filip Petrásek* ***Martin Štefaňák*** *Filip Petrásek (Gar.)*	Z,ZK	4	2+2	L	PS
18YZPRO	**Basics of Programming** *Jooyoung Hahn, Jakub Klinkovský, Miroslav Virius, Vladimír Jarý, Zuzana Petříčková, Jan Tomsa, Petr Pauš, Jan Vondruška* ***Miroslav Virius*** *Miroslav Virius (Gar.)*	Z	4	4C	Z	PS

Characteristics of the courses of this group of Study Plan: Code=BSPFILTFAJ1 Name=BS P_FIBA LTF 1st year

02YDEF1	History of Physics 1	Z	2
Physics and its place in the system of sciences. The relationship of man and nature. Natural sciences in ancient Orientand Greece, Greek natural philosophers, Aristotle. Physics in Helenistic period, Archimed. Arabic science, European science in Middle Ages. Renaissance - da Vinci, Giordano Bruno. Copernicus, Kepler, Galileo, Huygens. The birth of physics as experimental science. Newton and his work.			
02YELMA	Electricity and Magnetism	Z,ZK	6
Electric charge, Coulomb's law, electrostatic field, Gauss' law. Electric dipole, polarization. Conductors anddielectrics. Electric current and circuits, conductivity. Basics of the relativity theory. Electrodynamic forces,magnetic field. Magnetic dipole, magnetics. Electromagnetic induction, ac currents. Electromagnetic waves,Maxwell equations			
01YLAL	Linear Algebra 1	Z	2
Vector space. Linear dependence and independence. Basis and dimension. Subspace. Linear mappings and their matrices. Frobenius theorem.			
01YLALZ	Linear Algebra 1, exam	ZK	2
01YLAL2	Linear Algebra 2	Z,ZK	4
Outline: 1. Inverse matrix and operator. 2. Permutation and determinant. 3. Spectral theory (eigenvalue, eigenvector, diagonalization). 4. Hermitian and quadratic forms. 5. Scalar product and orthogonality. 6. Metric geometry. 7. Riesz theorem and adjoint operator. Outline of the exercises: 1. Methods for calculation of inverse matrices. 2. Methods of calculation of determinants. 3. Calculation of eigenvalues and eigenvectors. 4. Hermitian and quadratic forms. Canonical form. 5. Scalar product and orthogonality. Calculation of orthogonal complements. 6. Geometry exercises and examples. 7. Adjoint operators.			
01YMAN	Calculus 1	Z	4
Basic calculus (real analysis, functions of one real variable, differential calculus).			
01YMANZ	Calculus 1, exam	ZK	4
01YMAN2	Calculus 2	Z,ZK	8
1. Continuation of differential calculus: Taylor´s Polynomials, Taylor´s formula 2. Infinite series: criteria of convergence, operations on series, absolute and conditional convergence 3. Real and complex power series, the Cauchy-Hadamard theorem, expansion of function into power series, summation of infinite series. 4. Theory of integrals: primitives, definite integral (Riemann definition), techniques of integration and application of integrals, Generalized Riemann integral			
02YMECH	Mechanics	Z	4
ntroduction to physics, physical quantities and units. Particle kinematics, basic types of motion and theirsuperposition. Particle dynamics, one-dimensional equations of motion, motion in central force field, forces innoninertial reference frames. Mechanics of system of free particles, two-body problem, collisions. Mechanics ofrigid body, rotation. Fundamentals of continuum mechanics, elasticity, hydrodynamics. Sound.			
02YMECHZ	Mechanics - Examination	ZK	2
The content of the subject is the examination according to the plan of studies.			
00YPT	Orientation Week	Z	2
The preparatory week is intended for incoming bachelor's students. It includes an introduction to the organizational requirements of university studies and introductory lectures for the first semester.			
02YTER	Heat and Molecular Physics	Z,ZK	4
Heat propagation, calorimetry, the zeroth law of thermodynamics, thermal expansion and expansivity, one-dimensional steady-state heat conduction, heat transfer, Fouriers law, heat equation, radial part of the Laplace operator, differential forms, Jacobian method, first law of thermodynamics, homogeneous chemical system, ideal gas, processes in an ideal gas, second law of thermodynamics, thermal efficiency, Carnot heat engine, Carnots theorem I, absolute temperature, Carnots theorem II, entropy, ideal gas entropy, Gibbs paradox, thermodynamic potentials, Maxwells relations, real gas models, the Joule-Thomson experiment, Maxwell velocity distribution, thermodynamics of non-chemical systems, the third law of thermodynamics.			
18YZPRO	Basics of Programming	Z	4
This course is intended mainly for students with little or no experience in programming. It familiarizes the students with the basic concepts in programming and with the Python programming language.			

Code of the group: BSPFILTFAJ2
Name of the group: BS P_FIBA LTF 2nd year
Requirement credits in the group: In this group you have to gain at least credits (at most 0)
Requirement courses in the group: In this group you have to complete at least 11 courses
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
02YPRA1	**Experimental Laboratory 1** *Jaroslav Bielčík* ***Jaroslav Bielčík*** *Jaroslav Bielčík (Gar.)*	KZ	6	0+4	Z	PS
02YPRA2	**Experimental Laboratory 2** *Jaroslav Bielčík* ***Jaroslav Bielčík*** *Jaroslav Bielčík (Gar.)*	KZ	6	0+4	L	PS
12LTB1	**Laser Technique 1** *Helena Jelínková, Jan Šulc, Michal Němec* ***Jan Šulc*** *Helena Jelínková (Gar.)*	Z,ZK	3	2P+1C	L	PS
01YANB3	**Calculus B 3** *Andrii Anikushyn* ***Andrii Anikushyn*** *Andrii Anikushyn (Gar.)*	Z,ZK	8	4P+4C		PS
01YANB4	**Calculus B 4** *Andrii Anikushyn* ***Andrii Anikushyn*** *Andrii Anikushyn (Gar.)*	Z,ZK	6	2P+4C		PS
12YNME1	**Numerical Methods 1** *Jan Vábek, Pavel Váchal* ***Pavel Váchal*** *Pavel Váchal (Gar.)*	Z,ZK	4	2+2	L	PS
02YTEF1	**Theoretical Physics 1** *Jiří Hrivnák, Petr Novotný* ***Petr Novotný*** *Jiří Hrivnák (Gar.)*	Z,ZK	4	2+2	Z	PS
02YTEF2	**Theoretical Physics 2** *Jiří Hrivnák, Petr Novotný* ***Petr Novotný*** *Jiří Hrivnák (Gar.)*	Z,ZK	4	2+2	L	PS
02YTSFA	**Thermodynamics and Statistical Physics** *Igor Jex, Jaroslav Novotný* ***Martin Štefaňák*** *Igor Jex (Gar.)*	Z,ZK	4	2+2	L	PS

02YVOAF	**Waves, Optics and Atomic Physics** *Josef Schmidt* ***Josef Schmidt*** *Petr Novotný (Gar.)*	Z,ZK	6	4+2	Z	PS
12YZMDT	**Measurement and Data Processing** *Josef Blažej, Ivan Procházka* ***Josef Blažej*** *Ivan Procházka (Gar.)*	Z,ZK	2	1P+1C	Z	PS

Characteristics of the courses of this group of Study Plan: Code=BSPFILTFAJ2 Name=BS P_FIBA LTF 2nd year

02YPRA1	Experimental Laboratory 1	KZ	6

Lecture is intended especially for students who intend to study some of the physical specializations of FNSPE(branch Physical Engineering, Nuclear Engineering). But it can be also attended by students interested in the otherspecializations. In Experimental laboratory students learn how to prepare for experiments (including work with theliterature), the implementation of the measurement (acquire of different experimental procedures and routines), willteach writing the records of measurement, processing and evaluation of results. At the same time practically extendthe knowledge gained in lectures on physics.

02YPRA2	Experimental Laboratory 2	KZ	6

Lecture is intended especially for students who intend to study some of the physical specializations of FNSPE(branch Physical Engineering, Nuclear Engineering). But it can be also attended by students interested in the otherspecializations. In Experimental laboratory students learn how to prepare for experiments (including work with theliterature), the implementation of the measurement (acquire of different experimental procedures and routines), willteach writing the records of measurement, processing and evaluation of results. At the same time practically extendthe knowledge gained in lectures on physics.

12LTB1	Laser Technique 1	Z,ZK	3

Open resonators. Stability. Transverse and Longitudinal Modes. Elements of Open Resonators. Threshold of laser oscillations. Gausian beam as an approximation of the fundamental mode. ABCD method. Optical radiation propagation in resonant medium. Two-level approximation. Equations for polarisation and inversion, dispersion, saturation. Coherent and non-coherent pulse propagation. Optical solitons. Photon echo. Superradiation. Amplified spontaneous emission Lasers without optical resonator.

01YANB3	Calculus B 3	Z,ZK	8

1. Functional sequences and series - convergence range, criteria of uniform convergence, continuity, limit, differentiation and integration of functional series, power series, Series Expansion, Taylor´s theorem. 2. Ordinary differential equations - equations of first order (method of integration factor, equation of Bernoulli, separation of variables, homogeneous equation and exact equation) and equations of higher order (fundamental system, reduction of order, variation of parameters, equations with constant coefficients and special right-hand side, Euler differential equation). 3. Metric spaces - metric, norm, scalar product, neighborhood, interior and exterior points, boundary point, isolated and non-isolated point, boundary of set, completeness of space, Hilbert spaces. Orthogonal polynomials. Complete orthogonal systems. 4. Fourier series - expansion of functions into Fourier series, trigonometric Fourier series and their convergence.

01YANB4	Calculus B 4	Z,ZK	6

[1] Diferenciální počet funkcí více proměnných a funkcionálních vektorů. [2] Funkce zadané implicitně. [3] Taylorovy řady funkce více proměnných. [4] Regulární zobrazení, záměna proměnných, nekartézské soustavy souřadnic. [5] Lokální, vázané a globální extrémy funkce více proměnných. [6] Základy teorie míry a obrys konstrukce Lebesgueovy míry. [7] Integrální počet funkce více proměnných - Riemannův a Lebesgueův integrál, základní vlastnosti, Fubiniova věta, věta o substituci. Leviho a Lebesgueova věta. Limita, spojitost a derivace integrálu podle parametru. [8] Integrály po křivkách a plochách. Integrální věty.

12YNME1	Numerical Methods 1	Z,ZK	4

The course explains the basic principles of numerical mathematics important for numerical solving of problems important for physics and technology. Methods for solution of tasks very important for physicists (ordinary differential equations, random numbers) are included in addition to the basic numerical methods. Integrated computational environment MATLAB is used as a demonstration tool. The seminars are held in computer laboratory.

02YTEF1	Theoretical Physics 1	Z,ZK	4

The course is an introduction to analytical mechanics. The students acquire knowledge of the basic concepts of the Lagrange and Hamiltonian formalism as well as diferent approaches to description of dynamics (Newtons, Lagrange, Hamilton and Hamilton-Jacobi equations). The efficiency of these methods is illustrated on elementary examples like the two-body problem, the motion of a system of constrained mass points, and of a rigid body. Advanced parts of the course cover differential and integral principles of mechanics. The subject is the first part of the course of classical theoretical physics (02TEF1, 02TEF2).

02YTEF2	Theoretical Physics 2	Z,ZK	4

Tensors and transformations in physics. Mechanics of point mass, rigid body and continuum. The special theory of relativity: relativistic mechanics and classical field theory in the Minkowski space-time. Classical electrodynamics: Maxwell's equations in the Minkowski space-time, electromagnetic waves in dielectric media, electromagnetic radiation in the dipole approximation.

02YTSFA	Thermodynamics and Statistical Physics	Z,ZK	4

Foundation of thermodynamics and statistical physics. Thermodynamic potential, the Joule Thomson effect,conditions of equilibrium, the Braun-Le Chatelier principle. Statistical entropy. Basics of many body descriptionfrom a statistical point of view (classical and quasiclassical regime within the frame of a canonical and grand-canonical ensemble, Fermi gas, models of crystals and the black body radiation). The Boltzmann equation is usedto discusses simple transport phenomena.

02YVOAF	Waves, Optics and Atomic Physics	Z,ZK	6

Wave phenomena in mechanics and electromagnetism: modes, standing and travelling waves, wave packets indispersive media. Wave optics: polarization, interference, diffraction, coherence. Geometrical optics. Introduction toquantum physics: black body radiation, quantum of energy, photoeffect, the Compton effect, the de Broglie waves,the Schrodinger equation, stationary states and spectra of finite systems.

12YZMDT	Measurement and Data Processing	Z,ZK	2

Basic knowledge for the measurements and data processing and result interpretation: errors, precision, accuracy, normal distribution and its propeties, data fitting, separation of the signal from the noise.

Code of the group: BSPFILTFAJ3
Name of the group: BS P_FIBA LTF 3rd year
Requirement credits in the group: In this group you have to gain at least credits (at most 0)
Requirement courses in the group: In this group you have to complete at least 12 courses
Credits in the group: 0
Note on the group:

Code	**Name of the course / Name of the group of courses** ***(in case of groups of courses the list of codes of their members)*** *Tutors,* ***authors*** *and guarantors (gar.)*	**Completion**	**Credits**	**Scope**	**Semester**	**Role**
12BPFI1	**Bachelor Project 1** ***Ivan Richter*** *Ladislav Kalvoda (Gar.)*	Z	5	0P+5C		PS

12BPFI2	**Bachelor Project 2** ***Ivan Richter*** *Ladislav Kalvoda (Gar.)*	Z	10	0P+10C		PS
02YKM1	**Quantum Mechanics 1** *Martin Štefaňák* ***Martin Štefaňák*** *Martin Štefaňák (Gar.)*	Z,ZK	6	4P+2C	Z	PS
12LTB2	**Laser Technique 2** *Helena Jelínková, Václav Kubeček* ***Václav Kubeček*** *Václav Kubeček (Gar.)*	Z,ZK	3	2P+1C	Z	PS
01YRMFB	**Equations of Mathematical Physics B** *Vladimir Lotoreichik, Václav Klika* ***Václav Klika*** *Václav Klika (Gar.)*	Z,ZK	5	2P+2C		PS
11YBSEM	**Bachelor Seminar** *Radka Mika Havlíková, Ladislav Kalvoda* ***Ladislav Kalvoda*** *Ladislav Kalvoda (Gar.)*	Z	1	0P+2C	L	PS
12YZPLT	**Basic Laser Technique Laboratory** *Josef Blažej, Václav Kubeček* ***Josef Blažej*** *Václav Kubeček (Gar.)*	KZ	6	0+4	L	PS
12YZPOP	**Basic Optical Laboratory** *Alžběta Špádová, Alexandr Jančárek* ***Alexandr Jančárek*** *Alexandr Jančárek (Gar.)*	KZ	6	0+4	L	PS
12YZELD	**Fundamentals of Electrodynamics** *Milan Šiňor* ***Milan Šiňor*** *Milan Šiňor (Gar.)*	Z,ZK	2	2+0	Z	PS
12YZFS	**Fundamentals of Photonic Structures** *Ivan Richter, Jiří Čtyroký* ***Jiří Čtyroký*** *Ivan Richter (Gar.)*	Z,ZK	2	2P	L	PS
11YZFP	**Basic to Solid State Physics** *Ladislav Kalvoda, Eva Mihóková* ***Eva Mihóková*** *Ladislav Kalvoda (Gar.)*	ZK	3		Z	PS
12YZAOP	**Fundamentals of Optics** *Ivan Richter, Pavel Kwiecien* ***Ivan Richter*** *Ivan Richter (Gar.)*	Z,ZK	2	2+0	Z	PS

Characteristics of the courses of this group of Study Plan: Code=BSPFILTFAJ3 Name=BS P_FIBA LTF 3rd year

12BPFI1	Bachelor Project 1	Z	5

The bachelor project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.

12BPFI2	Bachelor Project 2	Z	10

The bachelor project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.

02YKM1	Quantum Mechanics 1	Z,ZK	6

Abstract: The lecture describes the birth of quantum mechanics and description of one particle and more particles by elements of the Hilbert space as well as its time evolution. Besides that it includes description of observable quantities by operators in the Hilbert space and calculation of their spectra.

12LTB2	Laser Technique 2	Z,ZK	3

Laser oscillator, the rate equation, the laser amplifier, Q-switching, mode-locking

01YRMFB	Equations of Mathematical Physics B	Z,ZK	5

The subject of this course is solving integral equations, theory of generalized functions, classification of partial differential equations, theory of integral transformations, and solution of partial differential equations.

11YBSEM	Bachelor Seminar	Z	1

In the first part of the seminar, students familiarize themselves with the general principles of publishing and presenting scientific work and the formal requirements for bachelors degree projects at the faculty. The second part is designed as a practical training for the defence of the bachelors degree project. The students give oral presentations of the current state of the research results achieved during the work on their projects. Each presentation is followed by a discussion on scientific matters as well as on the possibilities of improving the students performance.

12YZPLT	Basic Laser Technique Laboratory	KZ	6

Lasers, solid state Nd:YAG laser, laser crystal, laser discharge lamp, laser cavity, resonator, free-running, Q-switching, laser amplifier. second harmonic, He-Ne glow discharges, laser diode, diode pumped Nd:YAG laser, CO2 laser marking, laser materials properties, non-linear transmission, laser beam transverse profile, acousto-optic modulators.

12YZPOP	Basic Optical Laboratory	KZ	6

The practical laboratories give advanced practical skills by experimental work in optics and optoelectronics. Laboratory records must be elaborated.

12YZELD	Fundamentals of Electrodynamics	Z,ZK	2

Subject starts by derivation of Maxwell-Lorentz microscopic equations followed by transition to Maxwell macroscopic theory. Using special theory of relativity formulae are found for transformation of field vectors between two inertial systems of coordinates with appropriate invariants. Wave and Helmholtz equations are derived. By expansion into plane monochromatic waves methods of solving these equations are studied in homogeneous media with gradually increasing complexity: isotropic without losses, with absoption, with dispersion, and non-isotropic. Finally, solution in weakly non-homogeneous madia is presented using the method of eiconal. Individual chapters are illustrated by appropriate examples.

12YZFS	Fundamentals of Photonic Structures	Z,ZK	2

The lecture covers the basics of photonic structures, it classifies photonic structures compares them with the electronic structures, summarizes their preparation and characterization. Specifically, the lecture discusses the basic physics and technology of optical waveguides; it introduces basic linear, nonlinear, and active structures of integrated photonics for applications in optical communications and sensors. Next, the attention is given to introduction of plasmonic structures and plasmonics, periodic structures and photonic crystals, metamaterials, metasurfaces, and finally to photonic structures for quantum technologies. Finally, the lecture is closed with student presentations on selected relevant topics and excursions to selected photonic laboratories.

11YZFP	Basic to Solid State Physics	ZK	3

Description of fundamental properties of solids following the long-range ordered arrangement of atoms in a crystal lattice. Based on an interpretation of the bonding forces between atoms, various types of crystals and their properties are defined. The model of crystalline lattice dynamics in harmonic approximation is described and basic thermal properties of crystals are derived. The periodic potential of the crystal lattice is introduced and its relation to the following model describing the energetic state of electrons in solids by means of electron energy bands explained. The special consequences of electronic band structure to the physical properties of solids are explained.

12YZAOP	Fundamentals of Optics	Z,ZK	2

The lecture covers the very basics of optics - electromagnetic theory, linear optical physics and material effects, basics of nonlinear effects, and geometrical optics. The main goal of the lecture is to obtain, on the bachelor level, broad and general information on optics, giving an essential orientation in the field, especially with respect to character of the bachelor work. Particular topics are further elaborated during departmental masters program. The lecture stems from the electrodynamic notion of plane waves in vacuum (including polarization effects), and further from material medium. It explains basics of linear and nonlinear response in material medium and dispersion properties. It next informs on consequences in anisotropic media, it explains processes induced by boundary conditions at interfaces. It also discusses the consequences of statistics on interference processes, explains elements of two-wave interference and their applications in interferometers. Based on the Fresnel diffraction integral, diffraction processes are presented in a graphical form, including fundamentals of grating diffraction. Based on this diffraction principle, basic functioning of holography is clarified. Finally, the lecture unravels the geometrical optics limit. It takes notice on geometrical approach imaging, substitutive schema of a paraxial imaging system, and optical aberrations. It shows fundamentals of imaging in optical instruments.

Name of the block: Compulsory elective courses
Minimal number of credits of the block: 0
The role of the block: PV

Code of the group: BSPFILTFPVAJ1
Name of the group: BS P_FIBA LTF Required optional courses 1st year
Requirement credits in the group: In this group you have to gain at least credits (at most 0)
Requirement courses in the group: In this group you have to complete at least 1 course
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
12UFN	**Introduction to Photonics and Nanostructures** *Ivan Richter, Pavel Kwiecien, Jan Proška **Ivan Richter** Ivan Richter (Gar.)*	KZ	3	2P+1C	L	PV
12YULTB	**Introduction to Laser Technique** *Helena Jelínková, Jan Šulc, Michal Němec **Jan Šulc** Helena Jelínková (Gar.)*	KZ	3	2P+1C	L	PV

Characteristics of the courses of this group of Study Plan: Code=BSPFILTFPVAJ1 Name=BS P_FIBA LTF Required optional courses 1st year

12UFN	Introduction to Photonics and Nanostructures	KZ	3
Overview of nanostructures and nanotechnologies; quantum technologies; quantum nanostructures; photonic structures; nanophotonics and nanoplasmonics; optical waveguides and fibers; integrated photonics; computer simulations; technological realization; student presentations			
12YULTB	Introduction to Laser Technique	KZ	3
Overview of electromagnetic radiation sources; laser principle; classification of lasers; characterization and rough application of various types of lasers; laser safety precautions. The laser amplifier, Q-switching, mode-locking.			

Code of the group: BSSPOLVEDYAJ
Name of the group: BS - Social Sciences
Requirement credits in the group:
Requirement courses in the group: In this group you have to complete at least 1 course
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
04YAPI	**Presentation Course** *Beatriz Vadillo Gonzalo **Jana Kovářová** Beatriz Vadillo Gonzalo (Gar.)*	Z	2	2S	Z	PV

Characteristics of the courses of this group of Study Plan: Code=BSSPOLVEDYAJ Name=BS - Social Sciences

04YAPI	Presentation Course	Z	2
The course will prepare students for presenting issues in their field by mastering the strategies and techniques of oral presentation. The course includes discussions (expressing views, comments, agreement, disagreement). Students will be able to respond to comments on their presentation and answer questions addressed to them after the presentation, which is a skill required for the defence of the Bachelor Project. Students will learn the basic structure of a Bachelor Project and rules for writing a paper.			

Code of the group: BSPJAZYKYZK
Name of the group: BS P languages
Requirement credits in the group:
Requirement courses in the group: In this group you have to complete at least 2 courses
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
04XAMZK	**English for Intermediate Students Examination** *Jana Kovářová, Slavěna Brownová **Jana Kovářová** Jana Kovářová (Gar.)*	ZK	4		Z	PV
04XAPZK	**English for Advanced Students Examination** *Slavěna Brownová, Darren Copeland **Jana Kovářová** Darren Copeland (Gar.)*	ZK	4		Z	PV
04XCESZZK	**Czech for Foreigners Beginners - Examination** *Slavěna Brownová **Jana Kovářová** Jana Kovářová (Gar.)*	ZK	4		Z	PV

04XCESMZK	**Czech for Intermediate Students Examination** *Jana Kovářová* ***Jana Kovářová*** *Jana Kovářová (Gar.)*	ZK	4		Z	PV
04XCESPZK	**Czech for Foreign Students - Advanced Examination** *Jana Kovářová* ***Jana Kovářová*** *Jana Kovářová (Gar.)*	ZK	4		Z	PV
04XFMZK	**French for Intermediate Students Examination** *Věra Šlechtová* ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	ZK	4		Z	PV
04XFPZK	**French for Advanced Students Examination** *Věra Šlechtová* ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	ZK	4		Z	PV
04XFZZK	**French for Beginners Examination** *Věra Šlechtová* ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	ZK	3		L	PV
04XNMZK	**German for Intermediate Students Examination** *Miloslava Čechová* ***Miloslava Čechová*** *Miloslava Čechová (Gar.)*	ZK	4		Z	PV
04XNPZK	**German for Advanced Students Examination** *Miloslava Čechová* ***Miloslava Čechová*** *Miloslava Čechová (Gar.)*	ZK	4		Z	PV
04XRMZK	**Russian for Intermediate Students Examination** *Zhanna Isaeva* ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	ZK	4		Z	PV
04XRPZK	**Russian for Advanced Students Examination** *Zhanna Isaeva* ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	ZK	4		Z	PV
04XRZZK	**Russian for Beginners Examination** *Zhanna Isaeva* ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	ZK	3		L	PV
04XSMZK	**Spanish for Intermediate Students Examination** *Beatriz Vadillo Gonzalo* ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	ZK	4		Z	PV
04XSPZK	**Spanish for Advanced Students Examination** *Beatriz Vadillo Gonzalo* ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	ZK	4		Z	PV
04XSZZK	**Spanish for Beginners Examination** *Beatriz Vadillo Gonzalo* ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	ZK	3		L	PV

Characteristics of the courses of this group of Study Plan: Code=BSPJAZYKYZK Name=BS P languages

04XAMZK	English for Intermediate Students Examination	ZK	4

The course content is the examination as given by the study plan. The examination covers the AM1, AM2, and AM3 courses and consists of two parts - written (100 min) and oral (20-30 min). The student is expected to master the AM syllabus and demonstrate the ability to apply their knowledge gained in the three English courses.

04XAPZK	English for Advanced Students Examination	ZK	4

The course content is the examination as given by the study plan. The student is supposed to demonstrate mastering the 04XAP3 syllabus and the ability to apply their knowledge obtained in the three 04XAP courses. In addition to passing courses 04XAP1, 04XAP2, and 04XAP3, a prerequisite for taking the exam is a presentation on a specialized topic in the student's field. The examination consists of 2 parts - written and oral.

04XCESZZK	Czech for Foreigners Beginners - Examination	ZK	4

The course content is the examination as given by the study plan. The examination consisting of a written and oral part covers all the topics of the 04XCESZ1,2,3 courses and can only be taken after successful completion of all three courses. Detailed information is to be obtained from the teacher.

04XCESMZK	Czech for Intermediate Students Examination	ZK	4

The course content is the examination as given by the study plan. The examination consisting of a written and oral part covers all the topics of the CESM1,2,3 courses and can only be taken after successful completion of the 3 courses. Detailed information is to be obtained from the teacher.

04XCESPZK	Czech for Foreign Students - Advanced Examination	ZK	4

The course content is the examination as given by the study plan. The examination consisting of a written and oral part covers all the topics of the CESP1,2,3 courses and can only be taken after successful completion of the 3 courses. Detailed information is to be obtained from the teacher.

04XFMZK	French for Intermediate Students Examination	ZK	4

The content is the examination as given by the study programme. The whole French programme is ended with an examination covering the contents of FM1-FM3. The examination consists of a written and oral part and is organized according to Examination Instructions, a document available on the web.

04XFPZK	French for Advanced Students Examination	ZK	4

The whole French program is ended with an examination covering the contents of FP1-FP3. The examination consists of a written and/or an oral part and is organized according to Examination Instructions, a document available on the web. Assessment of the presentation is included into the examination grading.

04XFZZK	French for Beginners Examination	ZK	3

The content is the examination as given by the study plan. The course is terminated with an examination consisting of oral and written part. The examination is ruled by the document Instruction for examination. Its content covers the levels FZ1 - FZ5.

04XNMZK	German for Intermediate Students Examination	ZK	4

The course content is the examination as given by the study plan. The whole German for Intermediate Students Course is completed by an examination consisting of two parts - written and oral, which cover the courses NM1 - NM3. The oral part follows after passing the written part successfully and after obtaining the 04NM3 assessment. More detailed information is to be obtained from the teacher.

04XNPZK	German for Advanced Students Examination	ZK	4

The course content is the examination as given by the study plan. The whole German for Advanced Students Course is completed by an examination consisting of two parts - written and oral, which cover the courses NP1 - NP3. The oral part follows after passing the written part successfully and after obtaining the 04NP3 ungraded assessment. More detailed information is to be obtained from the teacher.

04XRMZK	Russian for Intermediate Students Examination	ZK	4

The course content is the examination as given by the study plan. The course is completed by taking a written and oral examination testing the knowledge and skills acquired in RM1 - RM3. Students are eligible for the oral examination only after a prior pass in RM3 and a successful written examination. Students are given instructions by the teacher.

04XRPZK	Russian for Advanced Students Examination	ZK	4

The course content is the examination as given by the study plan. The course is completed by taking a written and oral examination testing the knowledge and skills acquired in RP1 - RP3. Students are eligible for the oral examination only after a prior pass in RP3 and a successful written examination. Students are given instructions by the teacher.

04XRZZK	Russian for Beginners Examination	ZK	3

The course content is the examination as given by the study plan. The course is completed by taking a written and oral examination testing the knowledge and skills acquired in RZ1 - RZ5. Students are eligible for the oral examination only after a prior pass in RZ5 and a successful written examination. Students are given instructions by the teacher.

04XSMZK	Spanish for Intermediate Students Examination	ZK	4
The course content is the examination as given by the study plan. XSMZK examination consists of two parts: written and oral; to be eligible for the written part, students will have obtained non-graded assessment for course XSM3. Oral examination follows the written part.			
04XSPZK	Spanish for Advanced Students Examination	ZK	4
The course content is the examination as given by the study plan. Examination XSPZK consists of two parts, namely oral and written. The prerequisite for admission to oral part is having passed the written test. Examination content is based on syllabi of courses XSP1, XSP2, and XSP3 or on an individual study plan of the student.			
04XSZZK	Spanish for Beginners Examination	ZK	3
The course content is the examination as given by the study plan. Examination consists of two parts: written and oral. Students can register for oral examination only if they have passed the written examination test.			

Name of the block: Elective courses
Minimal number of credits of the block: 0
The role of the block: V

Code of the group: BSPFILTFAJV
Name of the group: BS P_FIBA LTF Optional courses
Requirement credits in the group: In this group you have to gain at least credits (at most 0)
Requirement courses in the group:
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
12YAPL	**Application of Lasers** *Helena Jelínková, Alexandr Jančárek* ***Helena Jelínková*** *Helena Jelínková (Gar.)*	Z,ZK	2	2+0	Z	v
02YDEF2	**History of Physics 2** *Igor Jex* ***Igor Jex*** *Igor Jex (Gar.)*	Z	2	2P+0C	L	v
14YELM	**Electron Microscopy** *Miroslav Karlík* ***Miroslav Karlík*** *Miroslav Karlík (Gar.)*	KZ	2	2P+0C		v
01YFKO	**Functions of Complex Variable** *Severin Pošta* ***Severin Pošta*** *Severin Pošta (Gar.)*	Z,ZK	3	2+1		v
02YFYS1	**Physical Seminar 1** ***Martin Štefaňák*** *Filip Petrásek (Gar.)*	Z	2	0+2	Z	v
02YKM2	**Quantum Mechanics 2** *Martin Štefaňák* ***Martin Štefaňák*** *Martin Štefaňák (Gar.)*	Z,ZK	6	4P+2C	L	v
12LAS	**Laser Systems** *Václav Kubeček* ***Václav Kubeček*** *Václav Kubeček (Gar.)*	Z,ZK	3	2+1	L	v
00YMAM1	**Essentials of High School Course 1** ***David Břeň*** *David Břeň (Gar.)*	Z	1	0+1	Z	v
00YMAM2	**Essentials of High School Math Course 2** *Lukáš Heriban* ***Lukáš Heriban*** *Lukáš Heriban (Gar.)*	Z	1	0+1		v
12MPP1	**Microprocessor Laboratory 1** ***David Vyhlídal*** *David Vyhlídal (Gar.)*	KZ	4	0+3	Z	v
12MPP2	**Microprocessor Laboratory 2** ***David Vyhlídal*** *David Vyhlídal (Gar.)*	KZ	4	0+3	L	v
12MPR1	**Microprocessors 1** *Miroslav Čech* ***Miroslav Čech*** *Miroslav Čech (Gar.)*	ZK	4	4+0	Z	v
12MPR2	**Microprocessors 2** *Miroslav Čech* ***Miroslav Čech*** *Miroslav Čech (Gar.)*	ZK	2	2+0	L	v
12MOF	**Molecular Physics** *Jan Proška, Martin Michl* ***Martin Michl*** *Martin Michl (Gar.)*	ZK	2	2+0	L	v
12NT	**Nanotechnology** *Jan Proška, Eduard Hulicius* ***Jan Proška*** *Eduard Hulicius (Gar.)*	ZK	2	2+0	Z	v
01YNME2	**Numerical Methods 2** *Michal Beneš* ***Michal Beneš*** *Michal Beneš (Gar.)*	KZ	2	2+0	L	v
15YCH1	**General Chemistry 1** *Petr Distler* ***Petr Distler*** *Petr Distler (Gar.)*	Z	3	2+1	Z	v
15CH2	**General Chemistry 2** *Petr Distler, Filip Babčický* ***Petr Distler*** *Petr Distler (Gar.)*	Z,ZK	3	2+1	L	v
12OSY	**Operating Systems** *Miroslav Čech* ***Miroslav Čech*** *Miroslav Čech (Gar.)*	ZK	3	3+0	Z	v
12YPAS	**Computer Algebra Systems** *Milan Šiňor* ***Milan Šiňor*** *Milan Šiňor (Gar.)*	Z	2	1P+1C	Z	v
01YPRST	**Probability and Statistics** *Anh Martina Neuman, Tomáš Hobza* ***Tomáš Hobza*** *Tomáš Hobza (Gar.)*	Z,ZK	4	3+1	Z	v
18YPRC1	**Programming in C++ 1** *Miroslav Virius, Vladimír Jarý* ***Miroslav Virius*** *Miroslav Virius (Gar.)*	Z	4	2+2	Z	v
18YPRC2	**Programming in C++ 2** *Miroslav Virius, Vladimír Jarý* ***Miroslav Virius*** *Miroslav Virius (Gar.)*	KZ	4	2+2	L	v

12YRSEN	**Control Systems and Sensors** *David Vyhlidal* ***David Vyhlídal*** *David Vyhlídal (Gar.)*	Z,ZK	4	4	Z	v
TV-1	**Physical Education**	Z	1		Z	v
TV-2	**Physical Education**	Z	1		L	v
TV-3	**Physical education**	Z	1	0+2	Z	v
TV-4	**Physical education**	Z	1	0+2	L	v
14YTED	**Creating Electronic Documents** ***Aleš Materna*** *Aleš Materna (Gar.)*	Z	2	26C		v
11UFP	**Introduction to Solid State Physics** *Petr Kolenko* ***Petr Kolenko*** *Petr Kolenko (Gar.)*	ZK	3		L	v
01UP1	**Introduction to Probability 1** *Jan Vybíral* ***Jan Vybíral*** *Jan Vybíral (Gar.)*	Z,ZK	3	1P+1C		v
01UP2	**Introduction to Probability 2** *Milan Krbálek, Michaela Krbálková* ***Michaela Krbálková*** *Milan Krbálek (Gar.)*	Z,ZK	3	1P+1C		v
12YUNXAP	**Introduction to UNIX** *Milan Kuchařík* ***Milan Kuchařík*** *Milan Kuchařík (Gar.)*	Z	2	1P+1C	L	v
12YUVP	**Introduction to Scientific Computing** *Milan Šiňor* ***Milan Šiňor*** *Milan Šiňor (Gar.)*	Z	2	1P+1C	L	v
12YVKT	**Vacuum Technology** *Richard Švejkar* ***Richard Švejkar*** *Vojtěch Petráček (Gar.)*	KZ	4	2P+2L	Z	v
12VTV	**Scientific and Technical Computing** *Ivan Procházka* ***Ivan Procházka*** *Ivan Procházka (Gar.)*	Z	2	1+1	L	v
12YVPMF	**Selected Topics in Modern Physics** *Jan Pšikal* ***Jan Pšikal*** *Jan Pšikal (Gar.)*	Z	3	2P+1C	L	v
12VFT	**High Frequency and Impulse Circuitry** *Jaroslav Pavel* ***Jaroslav Pavel*** *Jaroslav Pavel (Gar.)*	Z,ZK	2	2+0	L	v
12EPR1	**Basic Electronics Practicum 1** *Ivan Procházka, Jaroslav Pavel* ***Ivan Procházka*** *Jaroslav Pavel (Gar.)*	KZ	3	0+2	Z	v
12EPR2	**Basic Electronics Practicum 2** *Ivan Procházka, Jaroslav Pavel* ***Ivan Procházka*** *Jaroslav Pavel (Gar.)*	KZ	3	0+2	L	v
18YZALG	**Basics of Algorithmization** *Jooyoung Hahn, Miroslav Virius, Jan Bureš* ***Miroslav Virius***	Z,ZK	4	2+2	L	v
12ZEL1	**Basic Electronics 1** *Jaroslav Pavel* ***Jaroslav Pavel*** *Jaroslav Pavel (Gar.)*	Z,ZK	3	2+1	Z	v
12ZEL2	**Basic Electronics 2** *Jaroslav Pavel* ***Jaroslav Pavel*** *Jaroslav Pavel (Gar.)*	Z,ZK	3	2+1	L	v
02YZM1	**Foundations of Physical Measurements 1** *Solangel Rojas Torres, Libor Škoda, Peter Švihra, Petr Chaloupka* ***Martin Štefaňák*** *Petr Chaloupka (Gar.)*	ZK	2	2P+0C	Z	v
02YZM2	**Foundations of Physical Measurements 2** *Solangel Rojas Torres, Libor Škoda, Peter Švihra, Petr Chaloupka* ***Martin Štefaňák*** *Petr Chaloupka (Gar.)*	KZ	4	0P+4L	L	v
12YZFP	**Principles of Plasma Physics** *Martin Jirka, Jiří Limpouch* ***Martin Jirka*** *Jiří Limpouch (Gar.)*	Z,ZK	4	3+1	L	v
12ZFD	**Physics Data Visualization** *Josef Blažej* ***Josef Blažej*** *Josef Blažej (Gar.)*	KZ	2	1P+1C	Z	v

Characteristics of the courses of this group of Study Plan: Code=BSPFILTFAJV Name=BS P_FIBA LTF Optional courses

12YAPL	Application of Lasers	Z,ZK	2

Application of lasers in industrial technologies, medicine, remote sensing, energetics, telecommunication, military, entertainment and other branches.

02YDEF2	History of Physics 2	Z	2

Development of classical mechanics after Newton, Bernoulli's, Euler, Lagrange. Historical development of optics, corpuscular and wave approach. Electricity and magnetism - electrostatics, galvanism, electrodynamics and electromagnetism, Faraday and Maxwell. Thermodynamics and its laws, statistical physics, Boltzmann. The birth of modern quantum and relativistic physics, Planck and Einstein. Discovery of radioaktivity, structure of atom, atomic nucleus, Rutherford and Bohr. The way to nuclear energy, Elementary particles, standard model. The concept of Nature and Universe of today.

14YELM	Electron Microscopy	KZ	2

Abstract: In this course the students are introduced to the microscopic methods used for the characterization of materials, thin layers or nanoparticles. The introductory part is dedicated to the analogy of light and electron microscopy and to various types of microscopes. An important part of the course is given to the interaction of different types of radiation with matter, mathematical formulations and tools used in microscopy and to the description of particular parts of the microscopes. Introduction to kinematic and dynamic theory of diffraction, types of contrast, and diffraction and imaging techniques are also covered. A particular attention is given to analytical methods and imaging techniques in atomic resolution.

01YFKO	Functions of Complex Variable	Z,ZK	3

The course starts from outlining the Jordan curve theorem and the Riemann-Stieltjes integral. Then basic results of complex analysis in one variable are explained in detail: the derivative of a complex function and the Cauchy-Riemann equations, holomorphic and analytic functions, the index of a point with respect to a closed curve, Cauchy's integral theorem, Morera's theorem, roots of a holomorphic function, analytic continuation, isolated singularities, the maximum modulus principle, Liouville's theorem, the Cauchy estimates, Laurent series, residue theorem.

02YFYS1	Physical Seminar 1	Z	2

The purpose of the seminar is to familiarize students with specific applications of the theoretical knowledge gained in the introductory physics and mathematics courses, within the framework of various topics, under the guidance of an experienced mentor. Formally, the seminar is conducted using the flipped classroom method, in which independent study at home and in-person instruction with the mentor alternate on a weekly basis.

02YKM2	Quantum Mechanics 2	Z,ZK	6

Abstract: The lecture expands the introduction to quantum mechanics with more general formalism of quantum theory, approximate methods and path integral. It summarizes the terminology and methods used in various applications of quantum mechanics and prepares the students for an effective scientific research and further study, in particular, of the modern formulations of quantum field theory.

12LAS	Laser Systems	Z,ZK	3
Pulsed solid state nanosecond lasers. Picosecond lasers. High energy laser systems. Laser fusion. Diode-pumped solid state lasers. Tunable lasers. Optical parametric generators and raman lasers. Semiconductor lasers for pumping of solid state lasers and diode pumped solid state lasers Amplified spontaneous emission. Ultraviolet lasers. X-ray lasers. High power continuous lasers. Infrared high power lasers. Submilimeter lasers. Lasers with high degree of coherence. Free electron lasers.			
00YMAM1	Essentials of High School Course 1	Z	1
Students are introduced to mathematical concepts and methods used in the introductory physics course.			
00YMAM2	Essentials of High School Math Course 2	Z	1
The course introduces the fundamental areas of mathematics essential for university studies and practical applications. It covers sets, logic, proofs, functions, derivatives, integrals, analytic geometry, combinatorics, and probability, with emphasis on understanding principles, rigor, and problem solving.			
12MPP1	Microprocessor Laboratory 1	KZ	4
Become acquainted with a development board based on PIC16F873A and PIC16F877A microcontrollers, development environment MPLAB X IDE, PRESTO programmer, ASIX UP program, and PICkit3 debugger. Programming in assembly and C language for microcontrollers. Basic operations with microcontroller modules.			
12MPP2	Microprocessor Laboratory 2	KZ	4
Learning to use more PIC16F877A internal modules on PVK40 development board: PWM module (Capture/Compare), parallel communication interface (controlling character LCD device), serial communication interface USART, serial communication interface I2C/SPI, microcontroller PIC18F45K20. Programming in C language for microcontrollers.			
12MPR1	Microprocessors 1	ZK	4
Microprocessor and microcomputer, microprocessor types, memory types CPU, memory, Input output. Code and data, addressing modes(direct, indirect, register, relative,..., stack memory, procedure calls, IO devices - program control, interrupt. Microprocessor Microchip PIC16F877A, Instruction codes- Assembler and Macroassembler, programming languages. RISC processors - principles			
12MPR2	Microprocessors 2	ZK	2
Architecture IA-32. Data types and addressing. Memory segmentation and paging. Real and privileged mode. Instruction set, Assembler. description.			
12MOF	Molecular Physics	ZK	2
Basic ideas on physics of molecules and molecular matter, and on structure-to-physical properties relationship. Methods of molecular structure determination.			
12NT	Nanotechnology	ZK	2
Lectures will introduce students mainly to modern technological methods of preparation of semiconductor, metal and dielectric nanostructures. Physical and chemical fundaments of different technologies (MBE, MOVPE, EBL, sol-gel and colloidal solution) will be explained. Substantive attention will be devoted to epitaxial technologies which are substantial for nanostructure preparation. Particular emphasis will be focused on detail characterization of "in situ" and "ex situ" techniques, their applications for heterostructure and nanostructure growths will be discussed as well. Some supportive technical methods - lithography, diffusion, evaporation, ion implantation, contact and dielectric layer preparation will be mentioned as well as soldering and encasement.			
01YNME2	Numerical Methods 2	KZ	2
The course is devoted to numerical solution of boundary-value problems and intial-boundary-value problems for ordinary and partial differential equations. It explains methods converting boundary-value problems to initial-value problems and finite-difference methods for elliptic, parabolic and first-order hyperbolic partial differential equations.			
15YCH1	General Chemistry 1	Z	3
The most important concepts, quantities and units used in chemistry are introduced in the course General Chemistry I. Their significance and practical use are illustrated by examples solved in exercises.			
15CH2	General Chemistry 2	Z,ZK	3
The course is taught only in the Czech language. The subject is the continuation of the course General chemistry I. The main attention is paid to general principles governing chemical processes. Using various examples, the fact that the validity of these principles is not restricted only to chemical processes is documented. The significance and practical use of explained principles are illustrated by examples solved in exercises.			
12OSY	Operating Systems	ZK	3
Operating systems kernel, memory management, process, multitasking, interprocess communication, input/output, drivers, queues, client-server, internet communication, Multilanguage environment, user interface, system security, open systems.			
12YPAS	Computer Algebra Systems	Z	2
Practically oriented introduction to computer algebra systems (CAS): their main characteristics, ways and means of using them. Constituent part is realized in computer classrooms: students acquire basic skills with CAS by solving relatively simple and basic tasks from mathematics and physics.			
01YPRST	Probability and Statistics	Z,ZK	4
It is a basic course of probability theory and mathematical statistics. The probability theory is build gradually beginning with the classical definition and continuing till the Kolmogorov definition. The notions as random variable, distribution function of random variable and characteristics of random variable are treated and basic limit theorems are stated and proved. On the basis of this theory the basic methods of mathematical statistics such as estimation of distribution parameters and hypothesis testing are explained.			
18YPRC1	Programming in C++ 1	Z	4
This course covers mainly the C programming language and non-object oriented features of the C++ language.			
18YPRC2	Programming in C++ 2	KZ	4
This course covers the object oriented programming and othesr advanced constructs in the C+;+ programming language and the Standard Template Library.			
12YRSEN	Control Systems and Sensors	Z,ZK	4
The lecture addresses the theory, analysis, and implementation of linear analog and digital control systems, as well as sensors for various physical quantities. Part of the lecture is devoted to computer modeling and simulation using MATLAB, along with practical measurements conducted by the students on a continuous system with analog control (a servomechanism with an electric motor) or a continuous system with discrete control (temperature control using a thermoelectric cooler module).			
TV-1	Physical Education	Z	1
TV-2	Physical Education	Z	1
TV-3	Physical education	Z	1
TV-4	Physical education	Z	1
14YTED	Creating Electronic Documents	Z	2
Basic skills for creating and presenting student theses. Individual exercises focus on creating and formatting texts, equations, charts, tables, presentations and entire documents in an office suite.			
11UFP	Introduction to Solid State Physics	ZK	3
The purpose of this lecture is to introduce the undergraduate students to the study of the solid state physics.			
01UP1	Introduction to Probability 1	Z,ZK	3
1.Random trial with finite set of possible results, classical probability, independent random events 2.Probability and combinatorics 3.Probability and geometry, Bertrands paradox 4.Conditional probability, Bayes theorem, medical diagnosis, Simpsons paradox 5.Random variable with discrete state space, its distribution and mean value 6.Problems involving the calculation of mean value 7.Probabilistic method in graph theory 8.Random algorithms, Morris algorithm and its variants			

01UP2	Introduction to Probability 2	Z,ZK	3
1. One-dimensional continuous random variable and its statistical description. 2. Distribution function and probability density. 3. Axiomatic introduction of probability and connection to measure theory. 4. Numerical characteristics of continuous random variables. 5. Selected variants of continuous distributions and their characteristics. 6. Elementary methods for point estimations. 7. Generating pseudorandom numbers from the selected distribution.			
12YUNXAP	Introduction to UNIX	Z	2
Computer and operating systems. Personal computer, workstation and supercomputers. Processor, memory, bus, devices, hard disk, network interface. Hardware and software. Principles of operating systems. Operating system UNIX. Basic principles, kernel, kernel services. Documentation. File system, file atributes, working with files. Text editors: vi, emacs. Command interpreter (shell) bash and its programming (scripts). Controlling processes, process status, computer load a process priorities. Standard tools. Computer networks. Local computer networks. Global computer networks. Addresses and protocols TCP/IP. Network configutation of a computer. Network services: hardware sharing, mail, scp, etc. Network applications			
12YUVP	Introduction to Scientific Computing	Z	2
Practically oriented Introduction to scientific computing. Constituent part of the course is realized in computer classroom.Students get acquinted with some basic tools fort scientific and technicval computing, data analysis, data visualisation and algorithm development.			
12YVKT	Vacuum Technology	KZ	4
Rarefied gasses: basic concepts and relations; diffusion,flow of rarefied gases. Flow and current of gas, conductivity. Interaction of gas with solid surface; sorption, desorption; gas transport through solid matter; evaporation, condensation;Vacuum generation: Pumping proces, Ultimative pressure, Pumping speedPumps and their properties:-Positive displacement pumps: Diaphragm, Sliding vane rotary, Diffusion, Molecular, Roots, Molecular and Turbomolecular pumps. Sorption pumps: Cryopumps, Cryo-Adsorption pumps, Sublimation and NEG pumps, Ion getter pumps..Vacuum measurements: vacuum gauges of total and partial pressure; pumping speed; gas flow, search for leaks. Materials and vacuum components and seals.Practical exercises.			
12VTV	Scientific and Technical Computing	Z	2
The students get familiar with methods of solving of computational problems in the scientific and technical practice, and with methods of their programming. The course is oriented mainly to programming in the Fortran language.			
12YVPMF	Selected Topics in Modern Physics	Z	3
The aim of this course is to improve students knowledge in modern parts of physics (such as measuring of gravitational waves, neutrinos, discovery of Higgs boson, principles of light emitting diodes, ...) with a partial help of computer algebra systems (e.g. Maple). Apart from the other courses related to modern physics taught in this study program, this course does not deal with detailed mathematical formalism of studied phenomena. Therefore, the secondary aim is the increase of students motivation for deeper understanding of modern physics and its laws in their following study			
12VFT	High Frequency and Impulse Circuitry	Z,ZK	2
The goals of course is to collect advanced knowledge in high frequency technics and high speed events. The course is focused on Maxwell equation solution, Gunn's diodes, high frequency technics, microwaves guidelines, striplines, oscillators, amplifiers and pulse generators.			
12EPR1	Basic Electronics Practicum 1	KZ	3
The aim of the practicum is 1) to acquire basics skills in electronics and 2) to learn independent problem solving, formulation of a task and formulation of the results. The practicum consists of blocks lasting 4 hours.			
12EPR2	Basic Electronics Practicum 2	KZ	3
The aim of the practicum is 1) to acquire basics skills in electronics and 2) to learn independent problem solving, formulation of a task and formulation of the results. The practicum consists of blocks lasting 4 hours.			
18YZALG	Basics of Algorithmization	Z,ZK	4
This course is devoted to selected algorithms and methods for algorithm design. This course intruduces selected methods for the determination of the algorithm complexity.			
12ZEL1	Basic Electronics 1	Z,ZK	3
The subject provides primary knowledge of circuit theory concerning principles of electronic circuits in both stationary and harmonic stable state. Circuit analysis methods for linear circuits include symbolic and complex method are explained. Proper circuit analysis is also lectured. The subject's final part deals with transient effects inside linear circuits.			
12ZEL2	Basic Electronics 2	Z,ZK	3
The subject follows up with the Basic Electronics 1. Semiconductor elements basic properties are explained. Thecourse's final part deals with basic themes of logical circuits field.			
02YZM1	Foundations of Physical Measurements 1	ZK	2
The lecture is designed for students of physical specializations (Experimental particle physics, Physical engineering, Nuclear engineering), however, it can be attended by students of other branches. The goal of the lecture is to introduce the basics of physical measurements, the methods of processing and evaluation of acquired data on a PC. Students learn the basic habits of work in a physics lab.			
02YZM2	Foundations of Physical Measurements 2	KZ	4
The lecture is designed for students of physical specializations (Experimental particle physics, Physical engineering, Nuclear engineering), however, it can be attended by students of other branches. The goal of the lecture is to introduce the basics of physical measurements, the methods of processing and evaluation of acquired data on a PC. Students learn the basic habits of work in a physics lab.			
12YZFP	Principles of Plasma Physics	Z,ZK	4
Basic physics of high temperature plasmas is explained using particle, kinetic and fluid approaches. It includes drift motions and adiabatic invariants, linear theory of waves in plasmas and propagation of electromagnetic waves in inhomogeneous plasmas. Basic non-linear effects, such as ponderomotive force, self-focusing and parametric instabilities are explained. It comprises brief introduction into magnetohydrodynamics and nuclear fusion. Basics of atomic physics od multiply-ionized plasmas are introduced.			
12ZFD	Physics Data Visualization	KZ	2
Vector graphics basics, scientific plots, dala visualization basics, measurements results presentation			

Code of the group: BSPJAZYKYZAP
Name of the group: BS P jazyky zap
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
04XAM1	**English for Intermediate Students M1** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	0+2	Z	v
04XAM2	**English for Intermediate Students M2** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	0+2	L	v
04XAM3	**English for Intermediate Students M3** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	0+2	Z	v
04XAP1	**English for Advanced Students P1** ***Jana Kovářová*** *Darren Copeland (Gar.)*	Z	2	0+2	Z	v
04XAP2	**English for Advanced Students P2** ***Jana Kovářová*** *Darren Copeland (Gar.)*	Z	2	0+2	L	v
04XAP3	**English for Advanced Students P3** ***Jana Kovářová*** *Darren Copeland (Gar.)*	Z	2	0+2	Z	v
04XCESZ1	**Czech for Foreigners - Beginners 1** *Slavěna Brownová, Věra Šlechtová* ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	0+2	Z	v
04XCESZ2	**Czech for Foreigners - Beginners 2** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	0+2	L	v
04XCESZ3	**Czech for Foreigners - Beginners 3** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	2S	Z	v
04XCESM1	**Czech for Foreigners - Intermediate 1** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	0+2	Z	v
04XCESM2	**Czech for Foreigners - Intermediate 2** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	0+2	L	v
04XCESM3	**Czech for Foreigners - Intermediate 3** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	0+2	Z	v
04XCESP1	**Czech for Foreign Students - Advanced 1** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	0+2	Z	v
04XCESP2	**Czech for Foreigners - Advanced 2** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	0+2	L	v
04XCESP3	**Czech for Foreigners - Advanced 3** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	2	0+2	Z	v
04XFM1	**French for Intermediate Students M1** ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	Z	2	0+2	Z	v
04XFM2	**French for Intermediate Students M2** ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	Z	2	0+2	L	v
04XFM3	**French for Intermediate Students M3** ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	Z	2	0+2	Z	v
04XFP1	**French for Advanced Students P1** ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	Z	2	0+2	Z	v
04XFP2	**French for Advanced Students P2** ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	Z	2	0+2	L	v
04XFP3	**French for Advanded Students P3** ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	Z	2	0+2	Z	v
04XFZ1	**French for Beginners Z1** ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	Z	2	0+4	L	v
04XFZ2	**French for Beginners Z2** ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	Z	2	0+4	Z	v
04XFZ3	**French for Beginners Z3** ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	Z	2	0+4	L	v
04XFZ4	**French for Beginners Z4** ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	Z	2	0+4	Z	v
04XFZ5	**French for Beginners Z5** ***Věra Šlechtová*** *Věra Šlechtová (Gar.)*	Z	2	0+4	L	v
04XNM2	**German for Intermediate Students M2** ***Miloslava Čechová*** *Miloslava Čechová (Gar.)*	Z	2	0+2	L	v
04XNM1	**German for Intermediate Students M1** ***Miloslava Čechová*** *Miloslava Čechová (Gar.)*	Z	2	0+2	Z	v
04XNM3	**German for Intermediate Students M3** ***Miloslava Čechová*** *Miloslava Čechová (Gar.)*	Z	2	0+2	Z	v
04XNP1	**German for Advanced Students P1** ***Miloslava Čechová*** *Miloslava Čechová (Gar.)*	Z	2	0+2	Z	v
04XNP2	**German for Advanced Students P2** ***Miloslava Čechová*** *Miloslava Čechová (Gar.)*	Z	2	0+2	L	v
04XNP3	**German for Advanced Students P3** ***Miloslava Čechová*** *Miloslava Čechová (Gar.)*	Z	2	0+2	Z	v
04XRM1	**Russian for Intermediate Students M1** ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	Z	2	0+2	Z	v
04XRM2	**Russian for Intermediate Students M2** ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	Z	2	0+2	L	v
04XRM3	**Russian for Intermediate Students M3** ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	Z	2	0+2	Z	v
04XRP1	**Russian for Advanced Students P1** ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	Z	2	0+2	Z	v

04XRP2	**Russian for Advanced Students P2** ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	Z	2	0+2	L	v
04XRP3	**Russian for Advanced Students P3** ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	Z	2	0+2	Z	v
04XRZ1	**Russian for Beginners Z1** ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	Z	2	0+4	L	v
04XRZ2	**Russian for Beginners Z2** ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	Z	2	0+4	Z	v
04XRZ3	**Russian for Beginners Z3** ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	Z	2	0+4	L	v
04XRZ4	**Russian for Beginners Z4** ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	Z	2	0+4	Z	v
04XRZ5	**Russian for Beginners Z5** ***Zhanna Isaeva*** *Zhanna Isaeva (Gar.)*	Z	2	0+4	L	v
04XSM1	**Spanish for Intermediate Students M1** ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	Z	2	0+2	Z	v
04XSM2	**Spanish for Intermediate Students M3** ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	Z	2	0+2	L	v
04XSM3	**Spanish for Intermediate Students M3** ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	Z	2	0+2	Z	v
04XSP1	**Spanish for Advanced Students P1** ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	Z	2	0+2	Z	v
04XSP2	**Spanish for Advanced Students P2** ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	Z	2	0+2	L	v
04XSP3	**Spanish for Advanced Students P3** ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	Z	2	0+2	Z	v
04XSZ1	**Spanish for Beginners Z1** ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	Z	2	0+4	L	v
04XSZ2	**Spanish for Beginners Students Z2** ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	Z	2	0+4	Z	v
04XSZ3	**Spanish for Beginners Z3** ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	Z	2	0+4	L	v
04XSZ4	**Spanish for Beginners Z4** ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	Z	2	0+4	Z	v
04XSZ5	**Spanish for Beginners Z5** ***Beatriz Vadillo Gonzalo*** *Beatriz Vadillo Gonzalo (Gar.)*	Z	2	0+4	L	v

Characteristics of the courses of this group of Study Plan: Code=BSPJAZYKYZAP Name=BS P jazyky zap

04XAM1	English for Intermediate Students M1	Z	2

The course is designed for students who have successfully completed the full secondary school English language course at least at the B1/B2 level of the Common European Framework of Reference for Languages (CEFR). It provides an introduction into English for Specific and Academic Purposes (ESP, EAP), i.e., into fundamentals of vocabulary and style typical of professional oral and written communication situations. Thus it covers topics related to the student´s life and needs as well as topics of subtechnical interest. Attention is also paid to extending the knowledge of grammar issues used in EAP.

04XAM2	English for Intermediate Students M2	Z	2

The AM2 course expects the student to have completed the AM1 course. It develops their skills for work with subtechnical texts, focusing also more on specific grammar, functions, and lexical items typical of ESP and EAP (e.g., definition, existence and classification of phenomena, object descriptions). Part of the course is also guided writing. If necessary, grammar revision is included.

04XAM3	English for Intermediate Students M3	Z	2

The course develops the skills that enable students to cope with features typical of professional style. Increasing attention is paid to developing subtechnical vocabulary and independent understanding of professional texts. Great emphasis is placed on distinguishing different levels of formal and informal oral and written communication and their appropriate Czech equivalents. The course also includes studying abstracts and rules for writing them as well as basic rules for preparing and giving a short presentation on a chosen topic related to the student´s field.

04XAP1	English for Advanced Students P1	Z	2

The course is at the level of advanced English, designed for students who have successfully completed the full secondary school English language course (at least to the B1 level of the Common European Framework of Reference for Languages - CEFR). It provides an introduction into English for Specific and Academic Purposes (ESP, EAP), providing insights into the fundamentals of vocabulary, grammar, and the purpose and style which is typical of academic and professional oral and written communication situations concerning science, technology, engineering and mathematics (STEM) contexts. There is an emphasis on reading material and discussing ideas with colleagues prior to participating in plenary sessions. Full and active participation is a basic expectation.

04XAP2	English for Advanced Students P2	Z	2

The course is designed for students who have successfully completed AP1 and is a continuation of the Advanced English course. The AP2 course builds on content covered in AP1, thus extending the students skills for working with texts relating to science, technology, engineering and mathematics (STEM), and honing spoken and written communication in STEM contexts. The course extends the students academic vocabulary, through exposure to a wide variety of diverse texts and broadens knowledge of key aspects of grammar (referred to as Language Topics), pertinent to effective academic discourse and communication. There is a specific emphasis on responding to graphic data and the synthesizing of comprehensive and nuanced interpretations of such data. There is a focus on formal conventions in written communication including sentence and paragraph structure, discourse marking and cohesion. As in AP1, considerations of the purpose and concomitant style which is typical of academic and professional oral and written communication is explored through sample materials. And once again, students are expected to discuss ideas with colleagues prior to participating in plenary sessions. Full and active participation is a basic expectation.

04XAP3	English for Advanced Students P3	Z	2

The AP3 course is designed for students who have successfully completed AP2 and is a continuation of the Advanced English course leading to a zápočet and a final graded examination. The AP3 course builds on content covered in both AP1 and AP2, and in terms of the final examinations, provides a summative assessment of the knowledge and skills acquired over the course of the three semesters. The AP3 course places greater emphasis on student participation, training oral communication skills, particularly when expressing an opinion, agreement, and objections in formal discussions. There is also focus on professional written communication in the context of applying for work placements and opportunities for further study. For most students this is their third year of studying for their bachelors degree and so there is a commitment to honing efficient and effective language skills with a view to enabling successful communication in English both in the academic context and in the wider world. Collaborating with colleagues to enable deeper understanding of complex ideas is a key goal.

04XCESZ1	Czech for Foreigners - Beginners 1	Z	2
The course is designed for students of the English programme. Students will become acquainted with the main characteristics of Czech (phonetic and grammar features) and they will acquire basic language and speaking skills. The course focuses on pronunciation exercises, simple social phrases, and oral and written communication in the most common everyday situations. The course covers roughly lessons 1-3 of Čeština Express (Czech Express) by L. Holá and P. Bořilová.			
04XCESZ2	Czech for Foreigners - Beginners 2	Z	2
The language and communication competences acquired in CESZ1 are further developed. Students deepen their knowledge of the declension and conjugation system and practise basic communication topics. The course covers roughly lessons 3-5 in Czech Express by L. Holá and P. Bořilová.			
04XCESZ3	Czech for Foreigners - Beginners 3	Z	2
The course further develops the language and communication competences acquired in the XCESZ1 and XCESZ2 courses. The teaching focuses on building up basic vocabulary, fixing correct pronunciation and deepening grammar, features through practice, as well as introducing the Czech culture. Students are asked to produce simple texts and they practise frequent types of dialogue. They also practise understanding texts in terms of main ideas or looking for specific details in texts. The course covers roughly lessons 5-7 in Čeština expres 1.			
04XCESM1	Czech for Foreigners - Intermediate 1	Z	2
The course is focused on correct pronunciation, important morphological phenomena, prepositional phrases, and verb forms as well as on extending the student´s vocabulary for various social situations.			
04XCESM2	Czech for Foreigners - Intermediate 2	Z	2
The course develops the topics covered in CESM1 and is then focused on more difficult grammar phenomena. It practices writing, speaking, and reading skills and trains the student in understanding common abbreviations, abbreviated words, and mathematical terms and formulas.			
04XCESM3	Czech for Foreigners - Intermediate 3	Z	2
The last course revises morphological topics covered earlier and extends the student´s knowledge of more difficult language phenomena. It is especially focused on stylistics and lexicology and on developing the student´s writing skills.			
04XCESP1	Czech for Foreign Students - Advanced 1	Z	2
The prerequisite of the course is very good knowledge of the Czech language, i.e., communicative competences at least at level B2 of the Common European Framework of Reference. It is focused partly on revision of standard language structures, but mainly on practising more complex grammatical structures typical of the style of science. Students are taught the basics of functional style of engineering and professional communication, both in spoken and written form. The topics include University Studies and Student Life. Written practice includes communication with teachers and faculty administrators.			
04XCESP2	Czech for Foreigners - Advanced 2	Z	2
This course extends the student´s knowledge acquired in CESP1 and focuses on difficult language phenomena. It practises working with technical and specialist texts placing greater emphasis on individual work.			
04XCESP3	Czech for Foreigners - Advanced 3	Z	2
The course develops the student´s knowledge from CESP2. It includes working with authentic specialist materials, their interpretation and presentation, and, finally, presentation of the student´s project. Writing skills necessary for professional communication are trained.			
04XFM1	French for Intermediate Students M1	Z	2
French - intermediate FM The objective of this three-semester course is to improve and further develop communication in the French language in both written and oral form. Students will be able to communicate in social interaction and in academic, scientific and professional environment. They will be able to use the language to transmit general and technical information and to solve problems. FM1 The course builds on and further develops linguistic competence acquired at secondary school. It revises, systemizes and expands language skills gained in previous study. The following topics are covered: University studies in our country and in France, writing of transactional letters, CV, personal statement, request, answer to an advert, French culture and geography, Paris. Topics of specialization: mathematics, physics. Reading technical and popular science texts, work based on these texts.			
04XFM2	French for Intermediate Students M2	Z	2
Course FM2 builds on FM1. Linguistic structures and competence acquired in previous study are systemized and expanded. Reading popular science texts, features typical for technical and scientific language (passives, nominalization, word formation). Topics: physics, power engineering, environment, Internet, success of French science and technology, French scientists, artists and architects. Description of an object, device, shapes, dimensions, material.			
04XFM3	French for Intermediate Students M3	Z	2
The course is focused on improvement and further development of linguistic competence acquired during the follow-up courses. Syntactic structures (subordinate and infinitive clauses, participle structures, compound tenses). Text summary. -Students prepare a written paper which will be delivered in form of an oral presentation in-class. The paper is linked to the field of students´ future specialisation or to their interest and generally covers a technical /applied science topic. It is not a translation but a creative work compiled from French articles and one´s own knowledge/experience. -Longer monologues on topics /situations set for the examination are prepared. Text structure, cohesion and coherence.			
04XFP1	French for Advanced Students P1	Z	2
FP advanced course The objective of this three-semester course is to improve and further develop communication in the French language in both written and oral form. Students will be able to communicate in social interaction and in academic, scientific and work environment. They will be able to use the language to transmit general and technical information and to solve problems. FP1 The course builds on and further develops linguistic competence acquired at secondary school. Difficult grammar topics are repeated and expanded: subjonctif, passé composé-imparfait, pronouns. The following specific topics are covered: University studies in our country and in France, writing of transactional letters, CV, personal statement, request, answer to an advert, environmental issues, success of French science and technology, chosen topics from French regional culture, Paris. Topics of specialization: mathematics, internet, physics, chemistry. Reading of technical and popular science texts, further work with these texts and interpretation.			
04XFP2	French for Advanced Students P2	Z	2
With the link to P1 contents, the course further develops language skills. Focus is put on reading popular science texts and on oral communication on given topics. Features typical of technical and scientific communication are stressed (passive voice, nominalization, word formation).			
04XFP3	French for Advanded Students P3	Z	2
The course is focused on systemization and improvement of acquired linguistic competence, skills and knowledge, and their use for communication in engineering environment. Special skill - translation of shorter texts (both from and into the language). Writing of a paper and making oral presentation in-class. The paper generally covers a technical /applied science topic. It is a creative work compiled from 3 French sources. Preparation of several set topics for oral examination.			
04XFZ1	French for Beginners Z1	Z	2
French for beginners The objective of this 5-level course is to be able to communicate in French orally and in writing in situations of everyday life , in socializing and in professional life. The course includes French for specific / technical communication and reading of popular science and scientific texts. FZ1 The objective is to be able to communicate at elementary level, actively using the knowledge of chosen elementary language. The contents is roughly outlined by lessons 1 - 7 of the textbook Pravda - Pravdová, French for beginners (Francouzština pro začátečky). It is extended with situations of communication and functions from the textbook Espaces I, lessons 1-4 : introductions, personal information, asking and giving the directions, simple instructions and questions. Special attention is paid to pronunciation. Spelling is explained in connection with pronunciation and grammar.			
04XFZ2	French for Beginners Z2	Z	2
The course is linking up with FZ1. Elementary linguistic knowledge and communication skills are expanded. The scope is given by lessons 8 - 13 of the textbook: Pravda - Pravdová : French for Beginners . Additional topics and skills are filled in from the textbook Espaces I, lesson 1 - 5 (introductions, invitation, welcoming, agreement - disagreement, apology, thanking, travelling, map of France, food, expression of will, wish, order, prohibition, pleasure). Correct pronunciation is practiced. Stress on oral communication. Specific topics covered: How does the machine work? A few expressions concerning the study. Name of University and Faculty.			

04XFZ3	French for Beginners Z3	Z	2
The course builts upon FZ2. Basic linguistic knowledge and skills are developed. The contents is given by lessons 14 - 18 of the textbook: Pravda - Pravdová: French for Beginners. Topics, functions and situations are complemented from other materials. Stress is put on oral communication in dialogues and on reading, both for information and loud as part of pronunciation practice. Reading covers short adapted texts of general interest first, and later popular science texts.			
04XFZ4	French for Beginners Z4	Z	2
The course builds up on FZ3. Basic linguistic knowledge and skills are further developed. Oral communication and reading skills are practiced. The contents is roughly covered with lessons 19 - 23 of the textbook French for Beginners, and is expanded with topics and functions from other materials. Reading is developed from the lecture notes French for Engineering Students of FJFI. The course covers generals and specific topics: health- illness, sport, free time, environment, study, travelling in France, Paris, shopping, weather, university in our country and in France, how to write CV, application, topics in mathematics, reading physics - mechanics, informatics, internet.			
04XFZ5	French for Beginners Z5	Z	2
All four skills acquired in FZ4 are further developed, as well as technical language. Students prepare a paper on a chosen popular science topic. They present it orally in the class. The general contents is covered by lessons 24 - 26 of the textbook: Pravda-Pravdova, French for Beginners, and is complemented from other materials. Topics: on physics from lecture notes, success of French science and technology, information about France. Grammar is systemized and complemented with syntax (subordinate clauses, typical conjunctions, subjunctive clauses, gerund, passive.			
04XNM2	German for Intermediate Students M2	Z	2
The course introduces other more complex grammatical structures and their application in communication based on technical texts, such as the relation between technology and society, the world at the beginning of the 21st century, linguistically more demanding texts on the environment, the language of mathematics, computers and car technology etc. Students practise reading for information and reading aloud, and appropriate language for various purposes in oral and written communication. The course systematically revises other grammatical phenomena important for professional discourse (participles, relative clauses).			
04XNM1	German for Intermediate Students M1	Z	2
The objective of the course is to level off the students´ skills in the German language. The course focuses on revision of more difficult phenomena and structures (e.g. the passive) and word formation processes (e.g. importance of verb prefixes). In the lexical part, it covers topics referring to higher education in both the Czech Republic and Germany, current environmental issues together with all necessary expressions and phrases, expressions and phrases needed to chemists, mathematicians, physicists, and the fundamentals of IT terminology. It develops communication on related topics and is aimed at correct pronunciation, grammatical correctness and understandability.			
04XNM3	German for Intermediate Students M3	Z	2
The course introduces other more complex grammatical structures and their application in communication based on technical texts, such as the relation between technology and society, the world at the beginning of the 21st century, linguistically more demanding texts on the environment, the language of mathematics, computers and car technology etc. Students practise reading for information and reading aloud, and appropriate language for various purposes in oral and written communication. The course systematically revises other grammatical phenomena important for professional discourse (participles, relative clauses).			
04XNP1	German for Advanced Students P1	Z	2
This course requires good grammar knowledge, extended general vocabulary, and good communication skills acquired at secondary school to be levelled off at the beginning of the course. The course is then focused on working with technical and scientific texts and practising reading techniques (skimming, scanning, reading for detail). It revises and develops more difficult grammar structures necessary for understanding a subtechnical text (passive voice, participles, participle structures) and it also focuses on practical everyday communication, i.e., telephoning.			
04XNP2	German for Advanced Students P2	Z	2
The course develops the students' skills in working with professional scientific texts (understanding, summarising, note-taking, interpreting) while extending their general and subtechnical vocabulary range. It introduces mathematical expressions and texts of nuclear power engineering. Increasing emphasis is placed on understanding and practising formal communication, both written and oral (CV, letter of application, interview, scholarship), and more complex grammatical structures (i.e., subjunctive, indirect speech).			
04XNP3	German for Advanced Students P3	Z	2
The course consists of 3 main parts (general communicative situations, grammar and technical topics). Students will develop their vocabulary in a variety of less common situations (traffic problems and car accidents, accident report, filling in a form, complaints). Based on presentations and technical and subtechnical texts, the vocabulary range in fields such as nuclear power engineering, the environment, computer science, and car technology, will also be extended. Only authentic professional texts are used. By means of a presentation, students are trained to process information gained from their reading of complex and difficult texts and present it to the class in a simplified oral form. The course also includes translation practice to and from German.			
04XRM1	Russian for Intermediate Students M1	Z	2
The course is designed for students with previous knowledge of Russian from secondary schools. Students are supposed to know the Russian alphabet (both printed and handwritten), basic vocabulary for communication in everyday situations (introductions, socializing, greetings, shopping for food and objects of everyday need, asking the way and giving directions), they can use basic grammar structures (verbal and nominal forms, irregular verbs, pronouns). The initial knowledge corresponds to the achievement level of the RZ2 course. The contents and scope of the course correspond approximately to the RZ3 course, but for half of the time allotted in the timetable.			
04XRM2	Russian for Intermediate Students M2	Z	2
The course is based on the RM1 course, its contents and scope correspond roughly to RZ4, however, for half of the time allotted in the timetable.			
04XRM3	Russian for Intermediate Students M3	Z	2
The course develops the knowledge and skills acquired in RM1 and RM2 and its contents and scope are roughly at the same level as those of RZ5, however, for half of the time allotted in the timetable.			
04XRP1	Russian for Advanced Students P1	Z	2
The entrance requirement for the course is to achieve the B1 CEFR level. The objective of the course is revision of standard language structures, practicing more difficult grammar structures, understanding the fundamentals of technical language and training writing skills.			
04XRP2	Russian for Advanced Students P2	Z	2
The course is based on RP1. It expands grammatical structures important for understanding technical texts (verbal adjectives, participles, passives, verb aspects, specific syntactic structures). Stress is put on independent oral and written communication.			
04XRP3	Russian for Advanced Students P3	Z	2
The course is based on RP2 and is mainly focused on working with technical and scientific texts (reading comprehension, oral and written paraphrasing, translation). The RP1 - RP3 courses require good previous knowledge of general language at secondary level (listening, reading, correct communication in everyday situations). The courses develop and expand these skills. Further study is aimed at professional and technical skills (reading technical literature according to the students´ specialization, oral and written interpretation). Students develop their subtechnical vocabulary and practice quick and correct communication in professional situations. They will be able to both speak write accurately and with confidence on technical topics.			
04XRZ1	Russian for Beginners Z1	Z	2
The course represents the first stage of the five-semester programme, its final aim being reading and understanding professional texts written in Russian. Thus it begins with mastering the Russian alphabet (for both reading and writing skills) and fundamentals of grammar necessary for everyday communication (listening and speaking). Students will be able to read a short text with marked stress, understand its contents and summarize it.			

04XRZ2	Russian for Beginners Z2	Z	2
The second semester of the programme is designed to teach skills for basic communication in everyday situations and for reading easy and short subtechnical texts. Students will be able to communicate using short sentences and appropriate structures, and read aloud with confidence a short text without marked stress. They will also develop their vocabulary and master further grammatical structures. They will have mastered with confidence the Russian alphabet and will be able to use it in writing.			
04XRZ3	Russian for Beginners Z3	Z	2
The course is based on RZ2 and includes further everyday topics, develops understanding of short compact texts on new subtechnical topics (for training various forms of reading skills and listening) and introduces new grammar. Students will be trained to distinguish intonation patterns while listening to spoken language. They will be able to respond so as to be understood, and to express their opinion. Writing skills will be trained on guided writing tasks and note-taking.			
04XRZ4	Russian for Beginners Z4	Z	2
The course is based on RZ3. It improves and expands the knowledge of general language in all four skills (reading and understanding longer texts with a certain percentage of unfamiliar words, oral communication in everyday situations, writing longer texts). Students are trained to use grammar structures effectively (e.g., irregular verbs, differences in verb patterns from Czech, modality, imperatives, conditionals). They practice and develop communication skills for everyday situations (food, travelling, free time), and practice oral and written communication on more specific topics (environment, addictions, the green movement). They become acquainted with various geographical data (e.g., Siberia), learn how to fill in forms, look up the information from the timetable, learn about Russian holidays and typical meals.			
04XRZ5	Russian for Beginners Z5	Z	2
The course expects the student to have completed RZ4. It concentrates predominantly on reading skills (working with professional texts, i.e. understanding, extracting and summarizing information from a specialized text) and speaking, and to a certain extent, writing about the professional information obtained by reading the texts. Communication skills are trained on everyday topics. Studying grammar is based on professional and technical texts and only includes items typically used in professional communication (verbal adjectives, participles, passive voice). Students develop their technical and economic vocabulary, and are also trained in some professional skills (writing a CV, polite request, etc.)			
04XSM1	Spanish for Intermediate Students M1	Z	2
The course is designed for students whose competence is at level B1 of CEFR, i.e. those who studied Spanish in the secondary school. The 3-semester course develops standard vocabulary and pays attention to further grammar topics, to written and oral communication on a given everyday or easy subtechnical topic, for which the students are trained by reading texts or listening to them.			
04XSM2	Spanish for Intermediate Students M3	Z	2
The course develops the students´ knowledge from the previous course (XSM1). Students are gradually acquainted with fundamentals of Spanish for specific purposes in order to be able to work with specialized texts on the Internet.			
04XSM3	Spanish for Intermediate Students M3	Z	2
The course books are supplemented with additional subtechnical materials, so the students will be gradually acquainted with the peculiarities of academic style. They will be competent enough to use the Internet in Spanish and search for information of their specialization or field of interest. Students will use the information to write short articles and summaries. The final part of the programme, general Spanish course based on course books, covers presentations and, finally, a written and oral examination.			
04XSP1	Spanish for Advanced Students P1	Z	2
Course concentrates on more difficult grammar topics, revision of vocabulary, basics of Spanish for specific purposes as well as written communication. Course prerequisites: level B2 of CEFR.			
04XSP2	Spanish for Advanced Students P2	Z	2
Course XSP2 is the second part of the advanced Spanish course, extending Spanish for specific purposes topics. It comprises more grammar and syntax and focuses on independent written communication.			
04XSP3	Spanish for Advanced Students P3	Z	2
Course XSP3 is the final part of the advanced Spanish course. It is based on texts chosen by the students according to their future specialization. It is focused on written communication based on what students will need in their career.			
04XSZ1	Spanish for Beginners Z1	Z	2
Course XSZ1 is the first stage of the five-semester programme of Spanish studies; during the first stage the students will master phonetics and fundamental grammar structures and will be able to communicate at an elementary level on topics of everyday life. They will acquire and extend fundamental vocabulary of general Spanish and will develop it.			
04XSZ2	Spanish for Beginners Students Z2	Z	2
Course XSZ2 is based on course XSZ1, and expects students to develop and extend the knowledge and skills acquired so far. Grammar structures and lexis will be chosen so as to enable them to understand short adapted written texts and speech. Attention is also paid to cultural differences between Spanish-speaking countries and others such as the Czech Republic. Realia of Spanish-speaking countries are also included.			
04XSZ3	Spanish for Beginners Z3	Z	2
This course builds upon the foundations established in course XSZ2 and further develops students vocabulary and grammatical competence. It includes an introduction to the realia and cultural context of Spanish-speaking countries, with a primary focus on Spain. Particular attention is given to key grammatical structures, including the pretérito perfecto, pretérito indefinido, pretérito imperfecto, the gerund, and the imperative. The course also focuses on both written and spoken communication on general topics. Students are prepared for this through targeted reading and listening activities.			
04XSZ4	Spanish for Beginners Z4	Z	2
The course is based on course XSZ3. It develops the student´s vocabulary and extends the knowledge of the culture and social customs of the Spanish speaking countries, mainly of Spain. It pays attention to further grammar topics (perífrasis verbales, futuro imperfecto, direct object and indirect object pronouns, negative form of the imperative, and subjunctive), to written and oral communication on a given general or subtechnical topic, for which the student is trained by reading texts or listening to them.			
04XSZ5	Spanish for Beginners Z5	Z	2
The course books are supplemented with additional subtechnical materials, so the students will be gradually acquainted with peculiarities of Spanish for specific purposes. In its final part, the general Spanish course based on the course book will end with a written and oral examination.			

List of courses of this pass:

Code	Name of the course	Completion	Credits
00YMAM1	Essentials of High School Course 1	Z	1
Students are introduced to mathematical concepts and methods used in the introductory physics course.			
00YMAM2	Essentials of High School Math Course 2	Z	1
The course introduces the fundamental areas of mathematics essential for university studies and practical applications. It covers sets, logic, proofs, functions, derivatives, integrals, analytic geometry, combinatorics, and probability, with emphasis on understanding principles, rigor, and problem solving.			

00YPT	Orientation Week	Z	2
The preparatory week is intended for incoming bachelor's students. It includes an introduction to the organizational requirements of university studies and introductory lectures for the first semester.			
01UP1	Introduction to Probability 1	Z,ZK	3
1.Random trial with finite set of possible results, classical probability, independent random events 2.Probability and combinatorics 3.Probability and geometry, Bertrands paradox 4.Conditional probability, Bayes theorem, medical diagnosis, Simpsons paradox 5.Random variable with discrete state space, its distribution and mean value 6.Problems involving the calculation of mean value 7.Probabilistic method in graph theory 8.Random algorithms, Morris algorithm and its variants			
01UP2	Introduction to Probability 2	Z,ZK	3
1. One-dimensional continuous random variable and its statistical description. 2. Distribution function and probability density. 3. Axiomatic introduction of probability and connection to measure theory. 4. Numerical characteristics of continuous random variables. 5. Selected variants of continuous distributions and their characteristics. 6. Elementary methods for point estimations. 7. Generating pseudorandom numbers from the selected distribution.			
01YANB3	Calculus B 3	Z,ZK	8
1. Functional sequences and series - convergence range, criteria of uniform convergence, continuity, limit, differentiation and integration of functional series, power series, Series Expansion, Taylor´s theorem. 2. Ordinary differential equations - equations of first order (method of integration factor, equation of Bernoulli, separation of variables, homogeneous equation and exact equation) and equations of higher order (fundamental system, reduction of order, variation of parameters, equations with constant coefficients and special right-hand side, Euler differential equation). 3. Metric spaces - metric, norm, scalar product, neighborhood, interior and exterior points, boundary point, isolated and non-isolated point, boundary of set, completeness of space, Hilbert spaces. Orthogonal polynomials. Complete orthogonal systems. 4. Fourier series - expansion of functions into Fourier series, trigonometric Fourier series and their convergence.			
01YANB4	Calculus B 4	Z,ZK	6
[1] Diferenciální počet funkcí více proměnných a funkcionálních vektorů. [2] Funkce zadané implicitně. [3] Taylorovy řady funkce více proměnných. [4] Regulární zobrazení, záměna proměnných, nekartézské soustavy souřadnic. [5] Lokální, vázané a globální extrémy funkce více proměnných. [6] Základy teorie míry a obrys konstrukce Lebesgueovy míry. [7] Integrální počet funkce více proměnných - Riemannův a Lebesgueův integrál, základní vlastnosti, Fubiniova věta, věta o substituci. Leviho a Lebesgueova věta. Limita, spojitost a derivace integrálu podle parametru. [8] Integrály po křivkách a plochách. Integrální věty.			
01YFKO	Functions of Complex Variable	Z,ZK	3
The course starts from outlining the Jordan curve theorem and the Riemann-Stieltjes integral. Then basic results of complex analysis in one variable are explained in detail: the derivative of a complex function and the Cauchy-Riemann equations, holomorphic and analytic functions, the index of a point with respect to a closed curve, Cauchy's integral theorem, Morera's theorem, roots of a holomorphic function, analytic continuation, isolated singularities, the maximum modulus principle, Liouville's theorem, the Cauchy estimates, Laurent series, residue theorem.			
01YLAL	Linear Algebra 1	Z	2
Vector space. Linear dependence and independence. Basis and dimension. Subspace. Linear mappings and their matrices. Frobenius theorem.			
01YLAL2	Linear Algebra 2	Z,ZK	4
Outline: 1. Inverse matrix and operator. 2. Permutation and determinant. 3. Spectral theory (eigenvalue, eigenvector, diagonalization). 4. Hermitian and quadratic forms. 5. Scalar product and orthogonality. 6. Metric geometry. 7. Riesz theorem and adjoint operator. Outline of the exercises: 1. Methods for calculation of inverse matrices. 2. Methods of calculation of determinants. 3. Calculation of eigenvalues and eigenvectors. 4. Hermitian and quadratic forms. Canonical form. 5. Scalar product and orthogonality. Calculation of orthogonal complements. 6. Geometry exercises and examples. 7. Adjoint operators.			
01YLALZ	Linear Algebra 1, exam	ZK	2
01YMAN	Calculus 1	Z	4
Basic calculus (real analysis, functions of one real variable, differential calculus).			
01YMAN2	Calculus 2	Z,ZK	8
1. Continuation of differential calculus: Taylor´s Polynomials, Taylor´s formula 2. Infinite series: criteria of convergence, operations on series, absolute and conditional convergence 3. Real and complex power series, the Cauchy-Hadamard theorem, expansion of function into power series, summation of infinite series. 4. Theory of integrals: primitives, definite integral (Riemann definition), techniques of integration and application of integrals, Generalized Riemann integral			
01YMANZ	Calculus 1, exam	ZK	4
01YNME2	Numerical Methods 2	KZ	2
The course is devoted to numerical solution of boundary-value problems and intial-boundary-value problems for ordinary and partial differential equations. It explains methods converting boundary-value problems to initial-value problems and finite-difference methods for elliptic, parabolic and first-order hyperbolic partial differential equations.			
01YPRST	Probability and Statistics	Z,ZK	4
It is a basic course of probability theory and mathematical statistics. The probability theory is build gradually beginning with the classical definition and continuing till the Kolmogorov definition. The notions as random variable, distribution function of random variable and characteristics of random variable are treated and basic limit theorems are stated and proved. On the basis of this theory the basic methods of mathematical statistics such as estimation of distribution parameters and hypothesis testing are explained.			
01YRMFB	Equations of Mathematical Physics B	Z,ZK	5
The subject of this course is solving integral equations, theory of generalized functions, classification of partial differential equations, theory of integral transformations, and solution of partial differential equations.			
02YDEF1	History of Physics 1	Z	2
Physics and its place in the system of sciences. The relationship of man and nature. Natural sciences in ancient Orientand Greece, Greek natural philosophers, Aristotle. Physics in Helenistic period, Archimed. Arabic science, European science in Middle Ages. Renaissance - da Vinci, Giordano Bruno. Copernicus, Kepler, Galileo, Huygens. The birth of physics as experimental science. Newton and his work.			
02YDEF2	History of Physics 2	Z	2
Development of classical mechanics after Newton, Bernoulli's, Euler, Lagrange. Historical development of optics, corpuscular and wave approach. Electricity and magnetism - electrostatics, galvanism, electrodynamics and electromagnetism, Faraday and Maxwell. Thermodynamics and its laws, statistical physics, Boltzmann. The birth of modern quantum and relativistic physics, Planck and Einstein. Discovery of radioaktivity, structure of atom, atomic nucleus, Rutherford and Bohr. The way to nuclear energy, Elementary particles, standard model. The concept of Nature and Universe of today.			
02YELMA	Electricity and Magnetism	Z,ZK	6
Electric charge, Coulomb's law, electrostatic field, Gauss' law. Electric dipole, polarization. Conductors anddielectrics. Electric current and circuits, conductivity. Basics of the relativity theory. Electrodynamic forces,magnetic field. Magnetic dipole, magnetics. Electromagnetic induction, ac currents. Electromagnetic waves,Maxwell equations			
02YFYS1	Physical Seminar 1	Z	2
The purpose of the seminar is to familiarize students with specific applications of the theoretical knowledge gained in the introductory physics and mathematics courses, within the framework of various topics, under the guidance of an experienced mentor. Formally, the seminar is conducted using the flipped classroom method, in which independent study at home and in-person instruction with the mentor alternate on a weekly basis.			

02YKM1	Quantum Mechanics 1	Z,ZK	6
Abstract: The lecture describes the birth of quantum mechanics and description of one particle and more particles by elements of the Hilbert space as well as its time evolution. Besides that it includes description of observable quantities by operators in the Hilbert space and calculation of their spectra.			
02YKM2	Quantum Mechanics 2	Z,ZK	6
Abstract: The lecture expands the introduction to quantum mechanics with more general formalism of quantum theory, approximate methods and path integral. It summarizes the terminology and methods used in various applications of quantum mechanics and prepares the students for an effective scientific research and further study, in particular, of the modern formulations of quantum field theory.			
02YMECH	Mechanics	Z	4
ntroduction to physics, physical quantities and units. Particle kinematics, basic types of motion and theirsuperposition. Particle dynamics, one-dimensional equations of motion, motion in central force field, forces innoninertial reference frames. Mechanics of system of free particles, two-body problem, collisions. Mechanics ofrigid body, rotation. Fundamentals of continuum mechanics, elasticity, hydrodynamics. Sound.			
02YMECHZ	Mechanics - Examination	ZK	2
The content of the subject is the examination according to the plan of studies.			
02YPRA1	Experimental Laboratory 1	KZ	6
Lecture is intended especially for students who intend to study some of the physical specializations of FNSPE(branch Physical Engineering, Nuclear Engineering). But it can be also attended by students interested in the otherspecializations. In Experimental laboratory students learn how to prepare for experiments (including work with theliterature), the implementation of the measurement (acquire of different experimental procedures and routines), willteach writing the records of measurement, processing and evaluation of results. At the same time practically extendthe knowledge gained in lectures on physics.			
02YPRA2	Experimental Laboratory 2	KZ	6
Lecture is intended especially for students who intend to study some of the physical specializations of FNSPE(branch Physical Engineering, Nuclear Engineering). But it can be also attended by students interested in the otherspecializations. In Experimental laboratory students learn how to prepare for experiments (including work with theliterature), the implementation of the measurement (acquire of different experimental procedures and routines), willteach writing the records of measurement, processing and evaluation of results. At the same time practically extendthe knowledge gained in lectures on physics.			
02YTEF1	Theoretical Physics 1	Z,ZK	4
The course is an introduction to analytical mechanics. The students acquire knowledge of the basic concepts of the Lagrange and Hamiltonian formalism as well as diferent approaches to description of dynamics (Newtons, Lagrange, Hamilton and Hamilton-Jacobi equations). The efficiency of these methods is illustrated on elementary examples like the two-body problem, the motion of a system of constrained mass points, and of a rigid body. Advanced parts of the course cover differential and integral principles of mechanics. The subject is the first part of the course of classical theoretical physics (02TEF1, 02TEF2).			
02YTEF2	Theoretical Physics 2	Z,ZK	4
Tensors and transformations in physics. Mechanics of point mass, rigid body and continuum. The special theory of relativity: relativistic mechanics and classical field theory in the Minkowski space-time. Classical electrodynamics: Maxwell's equations in the Minkowski space-time, electromagnetic waves in dielectric media, electromagnetic radiation in the dipole approximation.			
02YTER	Heat and Molecular Physics	Z,ZK	4
Heat propagation, calorimetry, the zeroth law of thermodynamics, thermal expansion and expansivity, one-dimensional steady-state heat conduction, heat transfer, Fouriers law, heat equation, radial part of the Laplace operator, differential forms, Jacobian method, first law of thermodynamics, homogeneous chemical system, ideal gas, processes in an ideal gas, second law of thermodynamics, thermal efficiency, Carnot heat engine, Carnots theorem I, absolute temperature, Carnots theorem II, entropy, ideal gas entropy, Gibbs paradox, thermodynamic potentials, Maxwells relations, real gas models, the Joule-Thomson experiment, Maxwell velocity distribution, thermodynamics of non-chemical systems, the third law of thermodynamics.			
02YTSFA	Thermodynamics and Statistical Physics	Z,ZK	4
Foundation of thermodynamics and statistical physics. Thermodynamic potential, the Joule Thomson effect,conditions of equilibrium, the Braun-Le Chatelier principle. Statistical entropy. Basics of many body descriptionfrom a statistical point of view (classical and quasiclassical regime within the frame of a canonical and grand-canonical ensemble, Fermi gas, models of crystals and the black body radiation). The Boltzmann equation is usedto discusses simple transport phenomena.			
02YVOAF	Waves, Optics and Atomic Physics	Z,ZK	6
Wave phenomena in mechanics and electromagnetism: modes, standing and travelling waves, wave packets indispersive media. Wave optics: polarization, interference, diffraction, coherence. Geometrical optics. Introduction toquantum physics: black body radiation, quantum of energy, photoeffect, the Compton effect, the de Broglie waves,the Schrodinger equation, stationary states and spectra of finite systems.			
02YZM1	Foundations of Physical Measurements 1	ZK	2
The lecture is designed for students of physical specializations (Experimental particle physics, Physical engineering, Nuclear engineering), however, it can be attended by students of other branches. The goal of the lecture is to introduce the basics of physical measurements, the methods of processing and evaluation of acquired data on a PC. Students learn the basic habits of work in a physics lab.			
02YZM2	Foundations of Physical Measurements 2	KZ	4
The lecture is designed for students of physical specializations (Experimental particle physics, Physical engineering, Nuclear engineering), however, it can be attended by students of other branches. The goal of the lecture is to introduce the basics of physical measurements, the methods of processing and evaluation of acquired data on a PC. Students learn the basic habits of work in a physics lab.			
04XAM1	English for Intermediate Students M1	Z	2
The course is designed for students who have successfully completed the full secondary school English language course at least at the B1/B2 level of the Common European Framework of Reference for Languages (CEFR). It provides an introduction into English for Specific and Academic Purposes (ESP, EAP), i.e., into fundamentals of vocabulary and style typical of professional oral and written communication situations. Thus it covers topics related to the student´s life and needs as well as topics of subtechnical interest. Attention is also paid to extending the knowledge of grammar issues used in EAP.			
04XAM2	English for Intermediate Students M2	Z	2
The AM2 course expects the student to have completed the AM1 course. It develops their skills for work with subtechnical texts, focusing also more on specific grammar, functions, and lexical items typical of ESP and EAP (e.g., definition, existence and classification of phenomena, object descriptions). Part of the course is also guided writing. If necessary, grammar revision is included.			
04XAM3	English for Intermediate Students M3	Z	2
The course develops the skills that enable students to cope with features typical of professional style. Increasing attention is paid to developing subtechnical vocabulary and independent understanding of professional texts. Great emphasis is placed on distinguishing different levels of formal and informal oral and written communication and their appropriate Czech equivalents. The course also includes studying abstracts and rules for writing them as well as basic rules for preparing and giving a short presentation on a chosen topic related to the student´s field.			
04XAMZK	English for Intermediate Students Examination	ZK	4
The course content is the examination as given by the study plan. The examination covers the AM1, AM2, and AM3 courses and consists of two parts - written (100 min) and oral (20-30 min). The student is expected to master the AM syllabus and demonstrate the ability to apply their knowledge gained in the three English courses.			

04XAP1	English for Advanced Students P1	Z	2
The course is at the level of advanced English, designed for students who have successfully completed the full secondary school English language course (at least to the B1 level of the Common European Framework of Reference for Languages - CEFR). It provides an introduction into English for Specific and Academic Purposes (ESP, EAP), providing insights into the fundamentals of vocabulary, grammar, and the purpose and style which is typical of academic and professional oral and written communication situations concerning science, technology, engineering and mathematics (STEM) contexts. There is an emphasis on reading material and discussing ideas with colleagues prior to participating in plenary sessions. Full and active participation is a basic expectation.			
04XAP2	English for Advanced Students P2	Z	2
The course is designed for students who have successfully completed AP1 and is a continuation of the Advanced English course. The AP2 course builds on content covered in AP1, thus extending the students skills for working with texts relating to science, technology, engineering and mathematics (STEM), and honing spoken and written communication in STEM contexts. The course extends the students academic vocabulary, through exposure to a wide variety of diverse texts and broadens knowledge of key aspects of grammar (referred to as Language Topics), pertinent to effective academic discourse and communication. There is a specific emphasis on responding to graphic data and the synthesizing of comprehensive and nuanced interpretations of such data. There is a focus on formal conventions in written communication including sentence and paragraph structure, discourse marking and cohesion. As in AP1, considerations of the purpose and concomitant style which is typical of academic and professional oral and written communication is explored through sample materials. And once again, students are expected to discuss ideas with colleagues prior to participating in plenary sessions. Full and active participation is a basic expectation.			
04XAP3	English for Advanced Students P3	Z	2
The AP3 course is designed for students who have successfully completed AP2 and is a continuation of the Advanced English course leading to a zápočet and a final graded examination. The AP3 course builds on content covered in both AP1 and AP2, and in terms of the final examinations, provides a summative assessment of the knowledge and skills acquired over the course of the three semesters. The AP3 course places greater emphasis on student participation, training oral communication skills, particularly when expressing an opinion, agreement, and objections in formal discussions. There is also focus on professional written communication in the context of applying for work placements and opportunities for further study. For most students this is their third year of studying for their bachelors degree and so there is a commitment to honing efficient and effective language skills with a view to enabling successful communication in English both in the academic context and in the wider world. Collaborating with colleagues to enable deeper understanding of complex ideas is a key goal.			
04XAPZK	English for Advanced Students Examination	ZK	4
The course content is the examination as given by the study plan. The student is supposed to demonstrate mastering the 04XAP3 syllabus and the ability to apply their knowledge obtained in the three 04XAP courses. In addition to passing courses 04XAP1, 04XAP2, and 04XAP3, a prerequisite for taking the exam is a presentation on a specialized topic in the student's field. The examination consists of 2 parts - written and oral.			
04XCESM1	Czech for Foreigners - Intermediate 1	Z	2
The course is focused on correct pronunciation, important morphological phenomena, prepositional phrases, and verb forms as well as on extending the student´s vocabulary for various social situations.			
04XCESM2	Czech for Foreigners - Intermediate 2	Z	2
The course develops the topics covered in CESM1 and is then focused on more difficult grammar phenomena. It practices writing, speaking, and reading skills and trains the student in understanding common abbreviations, abbreviated words, and mathematical terms and formulas.			
04XCESM3	Czech for Foreigners - Intermediate 3	Z	2
The last course revises morphological topics covered earlier and extends the student´s knowledge of more difficult language phenomena. It is especially focused on stylistics and lexicology and on developing the student´s writing skills.			
04XCESMZK	Czech for Intermediate Students Examination	ZK	4
The course content is the examination as given by the study plan. The examination consisting of a written and oral part covers all the topics of the CESM1,2,3 courses and can only be taken after successful completion of the 3 courses. Detailed information is to be obtained from the teacher.			
04XCESP1	Czech for Foreign Students - Advanced 1	Z	2
The prerequisite of the course is very good knowledge of the Czech language, i.e., communicative competences at least at level B2 of the Common European Framework of Reference. It is focused partly on revision of standard language structures, but mainly on practising more complex grammatical structures typical of the style of science. Students are taught the basics of functional style of engineering and professional communication, both in spoken and written form. The topics include University Studies and Student Life. Written practice includes communication with teachers and faculty administrators.			
04XCESP2	Czech for Foreigners - Advanced 2	Z	2
This course extends the student´s knowledge acquired in CESP1 and focuses on difficult language phenomena. It practises working with technical and specialist texts placing greater emphasis on individual work.			
04XCESP3	Czech for Foreigners - Advanced 3	Z	2
The course develops the student´s knowledge from CESP2. It includes working with authentic specialist materials, their interpretation and presentation, and, finally, presentation of the student´s project. Writing skills necessary for professional communication are trained.			
04XCESPZK	Czech for Foreign Students - Advanced Examination	ZK	4
The course content is the examination as given by the study plan. The examination consisting of a written and oral part covers all the topics of the CESP1,2,3 courses and can only be taken after successful completion of the 3 courses. Detailed information is to be obtained from the teacher.			
04XCESZ1	Czech for Foreigners - Beginners 1	Z	2
The course is designed for students of the English programme. Students will become acquainted with the main characteristics of Czech (phonetic and grammar features) and they will acquire basic language and speaking skills. The course focuses on pronunciation exercises, simple social phrases, and oral and written communication in the most common everyday situations. The course covers roughly lessons 1-3 of Čeština Express (Czech Express) by L. Holá and P. Bořilová.			
04XCESZ2	Czech for Foreigners - Beginners 2	Z	2
The language and communication competences acquired in CESZ1 are further developed. Students deepen their knowledge of the declension and conjugation system and practise basic communication topics. The course covers roughly lessons 3-5 in Czech Express by L. Holá and P. Bořilová.			
04XCESZ3	Czech for Foreigners - Beginners 3	Z	2
The course further develops the language and communication competences acquired in the XCESZ1 and XCESZ2 courses. The teaching focuses on building up basic vocabulary, fixing correct pronunciation and deepening grammar, features through practice, as well as introducing the Czech culture. Students are asked to produce simple texts and they practise frequent types of dialogue. They also practise understanding texts in terms of main ideas or looking for specific details in texts. The course covers roughly lessons 5-7 in Čeština expres 1.			
04XCESZZK	Czech for Foreigners Beginners - Examination	ZK	4
The course content is the examination as given by the study plan. The examination consisting of a written and oral part covers all the topics of the 04XCESZ1,2,3 courses and can only be taken after successful completion of all three courses. Detailed information is to be obtained from the teacher.			
04XFM1	French for Intermediate Students M1	Z	2
French - intermediate FM The objective of this three-semester course is to improve and further develop communication in the French language in both written and oral form. Students will be able to communicate in social interaction and in academic, scientific and professional environment. They will be able to use the language to transmit general and technical information and to solve problems. FM1 The course builds on and further develops linguistic competence acquired at secondary school. It revises, systemizes and expands language			

skills gained in previous study. The following topics are covered: University studies in our country and in France, writing of transactional letters, CV, personal statement, request, answer to an advert, French culture and geography, Paris. Topics of specialization: mathematics, physics. Reading technical and popular science texts, work based on these texts.

04XFM2	French for Intermediate Students M2	Z	2

Course FM2 builds on FM1. Linguistic structures and competence acquired in previous study are systemized and expanded. Reading popular science texts, features typical for technical and scientific language (passives, nominalization, word formation). Topics: physics, power engineering, environment, Internet, success of French science and technology, French scientists, artists and architects. Description of an object, device, shapes, dimensions, material.

04XFM3	French for Intermediate Students M3	Z	2

The course is focused on improvement and further development of linguistic competence acquired during the follow-up courses. Syntactic structures (subordinate and infinitive clauses, participle structures, compound tenses). Text summary. -Students prepare a written paper which will be delivered in form of an oral presentation in-class. The paper is linked to the field of students´ future specialisation or to their interest and generally covers a technical /applied science topic. It is not a translation but a creative work compiled from French articles and one´s own knowledge/experience. -Longer monologues on topics /situations set for the examination are prepared. Text structure, cohesion and coherence.

04XFMZK	French for Intermediate Students Examination	ZK	4

The content is the examination as given by the study programme. The whole French programme is ended with an examination covering the contents of FM1-FM3. The examination consists of a written and oral part and is organized according to Examination Instructions, a document available on the web.

04XFP1	French for Advanced Students P1	Z	2

FP advanced course The objective of this three-semester course is to improve and further develop communication in the French language in both written and oral form. Students will be able to communicate in social interaction and in academic, scientific and work environment. They will be able to use the language to transmit general and technical information and to solve problems. FP1 The course builds on and further develops linguistic competence acquired at secondary school. Difficult grammar topics are repeated and expanded: subjonctif, passé composé-imparfait, pronouns. The following specific topics are covered: University studies in our country and in France, writing of transactional letters, CV, personal statement, request, answer to an advert, environmental issues, success of French science and technology, chosen topics from French regional culture, Paris. Topics of specialization: mathematics, internet, physics, chemistry. Reading of technical and popular science texts, further work with these texts and interpretation.

04XFP2	French for Advanced Students P2	Z	2

With the link to P1 contents, the course further develops language skills. Focus is put on reading popular science texts and on oral communication on given topics. Features typical of technical and scientific communication are stressed (passive voice, nominalization, word formation).

04XFP3	French for Advanded Students P3	Z	2

The course is focused on systemization and improvement of acquired linguistic competence, skills and knowledge, and their use for communication in engineering environment. Special skill - translation of shorter texts (both from and into the language). Writing of a paper and making oral presentation in-class. The paper generally covers a technical /applied science topic. It is a creative work compiled from 3 French sources. Preparation of several set topics for oral examination.

04XFPZK	French for Advanced Students Examination	ZK	4

The whole French program is ended with an examination covering the contents of FP1-FP3. The examination consists of a written and/or an oral part and is organized according to Examination Instructions, a document available on the web. Assessment of the presentation is included into the examination grading.

04XFZ1	French for Beginners Z1	Z	2

French for beginners The objective of this 5-level course is to be able to communicate in French orally and in writing in situations of everyday life , in socializing and in professional life. The course includes French for specific / technical communication and reading of popular science and scientific texts. FZ1 The objective is to be able to communicate at elementary level, actively using the knowledge of chosen elementary language. The contents is roughly outlined by lessons 1 - 7 of the textbook Pravda - Pravdová, French for beginners (Francouzština pro začátečky). It is extended with situations of communication and functions from the textbook Espaces I, lessons 1-4 : introductions, personal information, asking and giving the directions, simple instructions and questions. Special attention is paid to pronunciation. Spelling is explained in connection with pronunciation and grammar.

04XFZ2	French for Beginners Z2	Z	2

The course is linking up with FZ1. Elementary linguistic knowledge and communication skills are expanded. The scope is given by lessons 8 - 13 of the textbook: Pravda - Pravdová : French for Beginners . Additional topics and skills are filled in from the textbook Espaces I, lesson 1 - 5 (introductions, invitation, welcoming, agreement - disagreement, apology, thanking, travelling, map of France, food, expression of will, wish, order, prohibition, pleasure). Correct pronunciation is practiced. Stress on oral communication. Specific topics covered: How does the machine work? A few expressions concerning the study. Name of University and Faculty.

04XFZ3	French for Beginners Z3	Z	2

The course builts upon FZ2. Basic linguistic knowledge and skills are developed. The contents is given by lessons 14 - 18 of the textbook: Pravda - Pravdová: French for Beginners. Topics, functions and situations are complemented from other materials. Stress is put on oral communication in dialogues and on reading, both for information and loud as part of pronunciation practice. Reading covers short adapted texts of general interest first, and later popular science texts.

04XFZ4	French for Beginners Z4	Z	2

The course builds up on FZ3. Basic linguistic knowledge and skills are further developed. Oral communication and reading skills are practiced. The contents is roughly covered with lessons 19 - 23 of the textbook French for Beginners, and is expanded with topics and functions from other materials. Reading is developed from the lecture notes French for Engineering Students of FJFI. The course covers generals and specific topics: health- illness, sport, free time, environment, study, travelling in France, Paris, shopping, weather, university in our country and in France, how to write CV, application, topics in mathematics, reading physics - mechanics, informatics, internet.

04XFZ5	French for Beginners Z5	Z	2

All four skills acquired in FZ4 are further developed, as well as technical language. Students prepare a paper on a chosen popular science topic. They present it orally in the class. The general contents is covered by lessons 24 - 26 of the textbook: Pravda-Pravdova, French for Beginners, and is complemented from other materials. Topics: on physics from lecture notes, success of French science and technology, information about France. Grammar is systemized and complemented with syntax (subordinate clauses, typical conjunctions, subjunctive clauses, gerund, passive.

04XFZZK	French for Beginners Examination	ZK	3

The content is the examination as given by the study plan. The course is terminated with an examination consisting of oral and written part. The examination is ruled by the document Instruction for examination. Its content covers the levels FZ1 - FZ5.

04XNM1	German for Intermediate Students M1	Z	2

The objective of the course is to level off the students´ skills in the German language. The course focuses on revision of more difficult phenomena and structures (e.g. the passive) and word formation processes (e.g. importance of verb prefixes). In the lexical part, it covers topics referring to higher education in both the Czech Republic and Germany, current environmental issues together with all necessary expressions and phrases, expressions and phrases needed to chemists, mathematicians, physicists, and the fundamentals of IT terminology. It develops communication on related topics and is aimed at correct pronunciation, grammatical correctness and understandability.

04XNM2	German for Intermediate Students M2	Z	2

The course introduces other more complex grammatical structures and their application in communication based on technical texts, such as the relation between technology and society, the world at the beginning of the 21st century, linguistically more demanding texts on the environment, the language of mathematics, computers and car technology etc. Students practise reading for information and reading aloud, and appropriate language for various purposes in oral and written communication. The course systematically revises other grammatical phenomena important for professional discourse (participles, relative clauses).

04XNM3	German for Intermediate Students M3	Z	2

The course introduces other more complex grammatical structures and their application in communication based on technical texts, such as the relation between technology and society, the world at the beginning of the 21st century, linguistically more demanding texts on the environment, the language of mathematics, computers and car technology etc. Students

	practise reading for information and reading aloud, and appropriate language for various purposes in oral and written communication. The course systematically revises other grammatical phenomena important for professional discourse (participles, relative clauses).		
04XNMZK	German for Intermediate Students Examination	ZK	4
	The course content is the examination as given by the study plan. The whole German for Intermediate Students Course is completed by an examination consisting of two parts - written and oral, which cover the courses NM1 - NM3. The oral part follows after passing the written part successfully and after obtaining the 04NM3 assessment. More detailed information is to be obtained from the teacher.		
04XNP1	German for Advanced Students P1	Z	2
	This course requires good grammar knowledge, extended general vocabulary, and good communication skills acquired at secondary school to be levelled off at the beginning of the course. The course is then focused on working with technical and scientific texts and practising reading techniques (skimming, scanning, reading for detail). It revises and develops more difficult grammar structures necessary for understanding a subtechnical text (passive voice, participles, participle structures) and it also focuses on practical everyday communication, i.e., telephoning.		
04XNP2	German for Advanced Students P2	Z	2
	The course develops the students' skills in working with professional scientific texts (understanding, summarising, note-taking, interpreting) while extending their general and subtechnical vocabulary range. It introduces mathematical expressions and texts of nuclear power engineering. Increasing emphasis is placed on understanding and practising formal communication, both written and oral (CV, letter of application, interview, scholarship), and more complex grammatical structures (i.e., subjunctive, indirect speech).		
04XNP3	German for Advanced Students P3	Z	2
	The course consists of 3 main parts (general communicative situations, grammar and technical topics). Students will develop their vocabulary in a variety of less common situations (traffic problems and car accidents, accident report, filling in a form, complaints). Based on presentations and technical and subtechnical texts, the vocabulary range in fields such as nuclear power engineering, the environment, computer science, and car technology, will also be extended. Only authentic professional texts are used. By means of a presentation, students are trained to process information gained from their reading of complex and difficult texts and present it to the class in a simplified oral form. The course also includes translation practice to and from German.		
04XNPZK	German for Advanced Students Examination	ZK	4
	The course content is the examination as given by the study plan. The whole German for Advanced Students Course is completed by an examination consisting of two parts - written and oral, which cover the courses NP1 - NP3. The oral part follows after passing the written part successfully and after obtaining the 04NP3 ungraded assessment. More detailed information is to be obtained from the teacher.		
04XRM1	Russian for Intermediate Students M1	Z	2
	The course is designed for students with previous knowledge of Russian from secondary schools. Students are supposed to know the Russian alphabet (both printed and handwritten), basic vocabulary for communication in everyday situations (introductions, socializing, greetings, shopping for food and objects of everyday need, asking the way and giving directions), they can use basic grammar structures (verbal and nominal forms, irregular verbs, pronouns). The initial knowledge corresponds to the achievement level of the RZ2 course. The contents and scope of the course correspond approximately to the RZ3 course, but for half of the time allotted in the timetable.		
04XRM2	Russian for Intermediate Students M2	Z	2
	The course is based on the RM1 course, its contents and scope correspond roughly to RZ4, however, for half of the time allotted in the timetable.		
04XRM3	Russian for Intermediate Students M3	Z	2
	The course develops the knowledge and skills acquired in RM1 and RM2 and its contents and scope are roughly at the same level as those of RZ5, however, for half of the time allotted in the timetable.		
04XRMZK	Russian for Intermediate Students Examination	ZK	4
	The course content is the examination as given by the study plan. The course is completed by taking a written and oral examination testing the knowledge and skills acquired in RM1 - RM3. Students are eligible for the oral examination only after a prior pass in RM3 and a successful written examination. Students are given instructions by the teacher.		
04XRP1	Russian for Advanced Students P1	Z	2
	The entrance requirement for the course is to achieve the B1 CEFR level. The objective of the course is revision of standard language structures, practicing more difficult grammar structures, understanding the fundamentals of technical language and training writing skills.		
04XRP2	Russian for Advanced Students P2	Z	2
	The course is based on RP1. It expands grammatical structures important for understanding technical texts (verbal adjectives, participles, passives, verb aspects, specific syntactic structures). Stress is put on independent oral and written communication.		
04XRP3	Russian for Advanced Students P3	Z	2
	The course is based on RP2 and is mainly focused on working with technical and scientific texts (reading comprehension, oral and written paraphrasing, translation). The RP1 - RP3 courses require good previous knowledge of general language at secondary level (listening, reading, correct communication in everyday situations). The courses develop and expand these skills. Further study is aimed at professional and technical skills (reading technical literature according to the students´ specialization, oral and written interpretation). Students develop their subtechnical vocabulary and practice quick and correct communication in professional situations. They will be able to both speak write accurately and with confidence on technical topics.		
04XRPZK	Russian for Advanced Students Examination	ZK	4
	The course content is the examination as given by the study plan. The course is completed by taking a written and oral examination testing the knowledge and skills acquired in RP1 - RP3. Students are eligible for the oral examination only after a prior pass in RP3 and a successful written examination. Students are given instructions by the teacher.		
04XRZ1	Russian for Beginners Z1	Z	2
	The course represents the first stage of the five-semester programme, its final aim being reading and understanding professional texts written in Russian. Thus it begins with mastering the Russian alphabet (for both reading and writing skills) and fundamentals of grammar necessary for everyday communication (listening and speaking). Students will be able to read a short text with marked stress, understand its contents and summarize it.		
04XRZ2	Russian for Beginners Z2	Z	2
	The second semester of the programme is designed to teach skills for basic communication in everyday situations and for reading easy and short subtechnical texts. Students will be able to communicate using short sentences and appropriate structures, and read aloud with confidence a short text without marked stress. They will also develop their vocabulary and master further grammatical structures. They will have mastered with confidence the Russian alphabet and will be able to use it in writing.		
04XRZ3	Russian for Beginners Z3	Z	2
	The course is based on RZ2 and includes further everyday topics, develops understanding of short compact texts on new subtechnical topics (for training various forms of reading skills and listening) and introduces new grammar. Students will be trained to distinguish intonation patterns while listening to spoken language. They will be able to respond so as to be understood, and to express their opinion. Writing skills will be trained on guided writing tasks and note-taking.		
04XRZ4	Russian for Beginners Z4	Z	2
	The course is based on RZ3. It improves and expands the knowledge of general language in all four skills (reading and understanding longer texts with a certain percentage of unfamiliar words, oral communication in everyday situations, writing longer texts). Students are trained to use grammar structures effectively (e.g., irregular verbs, differences in verb patterns from Czech, modality, imperatives, conditionals). They practice and develop communication skills for everyday situations (food, travelling, free time), and practice oral and written communication on more specific topics (environment, addictions, the green movement). They become acquainted with various geographical data (e.g., Siberia), learn how to fill in forms, look up the information from the timetable, learn about Russian holidays and typical meals.		

04XRZ5	Russian for Beginners Z5	Z	2
The course expects the student to have completed RZ4. It concentrates predominantly on reading skills (working with professional texts, i.e. understanding, extracting and summarizing information from a specialized text) and speaking, and to a certain extent, writing about the professional information obtained by reading the texts. Communication skills are trained on everyday topics. Studying grammar is based on professional and technical texts and only includes items typically used in professional communication (verbal adjectives, participles, passive voice). Students develop their technical and economic vocabulary, and are also trained in some professional skills (writing a CV, polite request, etc.)			
04XRZZK	Russian for Beginners Examination	ZK	3
The course content is the examination as given by the study plan. The course is completed by taking a written and oral examination testing the knowledge and skills acquired in RZ1 - RZ5. Students are eligible for the oral examination only after a prior pass in RZ5 and a successful written examination. Students are given instructions by the teacher.			
04XSM1	Spanish for Intermediate Students M1	Z	2
The course is designed for students whose competence is at level B1 of CEFR, i.e. those who studied Spanish in the secondary school. The 3-semester course develops standard vocabulary and pays attention to further grammar topics, to written and oral communication on a given everyday or easy subtechnical topic, for which the students are trained by reading texts or listening to them.			
04XSM2	Spanish for Intermediate Students M3	Z	2
The course develops the students´ knowledge from the previous course (XSM1). Students are gradually acquainted with fundamentals of Spanish for specific purposes in order to be able to work with specialized texts on the Internet.			
04XSM3	Spanish for Intermediate Students M3	Z	2
The course books are supplemented with additional subtechnical materials, so the students will be gradually acquainted with the peculiarities of academic style. They will be competent enough to use the Internet in Spanish and search for information of their specialization or field of interest. Students will use the information to write short articles and summaries. The final part of the programme, general Spanish course based on course books, covers presentations and, finally, a written and oral examination.			
04XSMZK	Spanish for Intermediate Students Examination	ZK	4
The course content is the examination as given by the study plan. XSMZK examination consists of two parts: written and oral; to be eligible for the written part, students will have obtained non-graded assessment for course XSM3. Oral examination follows the written part.			
04XSP1	Spanish for Advanced Students P1	Z	2
Course concentrates on more difficult grammar topics, revision of vocabulary, basics of Spanish for specific purposes as well as written communication. Course prerequisites: level B2 of CEFR.			
04XSP2	Spanish for Advanced Students P2	Z	2
Course XSP2 is the second part of the advanced Spanish course, extending Spanish for specific purposes topics. It comprises more grammar and syntax and focuses on independent written communication.			
04XSP3	Spanish for Advanced Students P3	Z	2
Course XSP3 is the final part of the advanced Spanish course. It is based on texts chosen by the students according to their future specialization. It is focused on written communication based on what students will need in their career.			
04XSPZK	Spanish for Advanced Students Examination	ZK	4
The course content is the examination as given by the study plan. Examination XSPZK consists of two parts, namely oral and written. The prerequisite for admission to oral part is having passed the written test. Examination content is based on syllabi of courses XSP1, XSP2, and XSP3 or on an individual study plan of the student.			
04XSZ1	Spanish for Beginners Z1	Z	2
Course XSZ1 is the first stage of the five-semester programme of Spanish studies; during the first stage the students will master phonetics and fundamental grammar structures and will be able to communicate at an elementary level on topics of everyday life. They will acquire and extend fundamental vocabulary of general Spanish and will develop it.			
04XSZ2	Spanish for Beginners Students Z2	Z	2
Course XSZ2 is based on course XSZ1, and expects students to develop and extend the knowledge and skills acquired so far. Grammar structures and lexis will be chosen so as to enable them to understand short adapted written texts and speech. Attention is also paid to cultural differences between Spanish-speaking countries and others such as the Czech Republic. Realia of Spanish-speaking countries are also included.			
04XSZ3	Spanish for Beginners Z3	Z	2
This course builds upon the foundations established in course XSZ2 and further develops students vocabulary and grammatical competence. It includes an introduction to the realia and cultural context of Spanish-speaking countries, with a primary focus on Spain. Particular attention is given to key grammatical structures, including the pretérito perfecto, pretérito indefinido, pretérito imperfecto, the gerund, and the imperative. The course also focuses on both written and spoken communication on general topics. Students are prepared for this through targeted reading and listening activities.			
04XSZ4	Spanish for Beginners Z4	Z	2
The course is based on course XSZ3. It develops the student´s vocabulary and extends the knowledge of the culture and social customs of the Spanish speaking countries, mainly of Spain. It pays attention to further grammar topics (perífrasis verbales, futuro imperfecto, direct object and indirect object pronouns, negative form of the imperative, and subjunctive), to written and oral communication on a given general or subtechnical topic, for which the student is trained by reading texts or listening to them.			
04XSZ5	Spanish for Beginners Z5	Z	2
The course books are supplemented with additional subtechnical materials, so the students will be gradually acquainted with peculiarities of Spanish for specific purposes. In its final part, the general Spanish course based on the course book will end with a written and oral examination.			
04XSZZK	Spanish for Beginners Examination	ZK	3
The course content is the examination as given by the study plan. Examination consists of two parts: written and oral. Students can register for oral examination only if they have passed the written examination test.			
04YAPI	Presentation Course	Z	2
The course will prepare students for presenting issues in their field by mastering the strategies and techniques of oral presentation. The course includes discussions (expressing views, comments, agreement, disagreement). Students will be able to respond to comments on their presentation and answer questions addressed to them after the presentation, which is a skill required for the defence of the Bachelor Project. Students will learn the basic structure of a Bachelor Project and rules for writing a paper.			
11UFP	Introduction to Solid State Physics	ZK	3
The purpose of this lecture is to introduce the undergraduate students to the study of the solid state physics.			
11YBSEM	Bachelor Seminar	Z	1
In the first part of the seminar, students familiarize themselves with the general principles of publishing and presenting scientific work and the formal requirements for bachelors degree projects at the faculty. The second part is designed as a practical training for the defence of the bachelors degree project. The students give oral presentations of the current state of the research results achieved during the work on their projects. Each presentation is followed by a discussion on scientific matters as well as on the possibilities of improving the students performance.			
11YZFP	Basic to Solid State Physics	ZK	3
Description of fundamental properties of solids following the long-range ordered arrangement of atoms in a crystal lattice. Based on an interpretation of the bonding forces between atoms, various types of crystals and their properties are defined. The model of crystalline lattice dynamics in harmonic approximation is described and basic thermal properties of			

crystals are derived. The periodic potential of the crystal lattice is introduced and its relation to the following model describing the energetic state of electrons in solids by means of electron energy bands explained. The special consequences of electronic band structure to the physical properties of solids are explained.			
12BPFI1	Bachelor Project 1	Z	5
The bachelor project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.			
12BPFI2	Bachelor Project 2	Z	10
The bachelor project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.			
12EPR1	Basic Electronics Practicum 1	KZ	3
The aim of the practicum is 1) to acquire basics skills in electronics and 2) to learn independent problem solving, formulation of a task and formulation of the results. The practicum consists of blocks lasting 4 hours.			
12EPR2	Basic Electronics Practicum 2	KZ	3
The aim of the practicum is 1) to acquire basics skills in electronics and 2) to learn independent problem solving, formulation of a task and formulation of the results. The practicum consists of blocks lasting 4 hours.			
12LAS	Laser Systems	Z,ZK	3
Pulsed solid state nanosecond lasers. Picosecond lasers. High energy laser systems. Laser fusion. Diode-pumped solid state lasers. Tunable lasers. Optical parametric generators and raman lasers. Semiconductor lasers for pumping of solid state lasers and diode pumped solid state lasers Amplified spontaneous emission. Ultraviolet lasers. X-ray lasers. High power continuous lasers. Infrared high power lasers. Submilimeter lasers. Lasers with high degree of coherence. Free electron lasers.			
12LTB1	Laser Technique 1	Z,ZK	3
Open resonators. Stability. Transverse and Longitudinal Modes. Elements of Open Resonators. Threshold of laser oscillations. Gausian beam as an approximation of the fundamental mode. ABCD method. Optical radiation propagation in resonant medium. Two-level approximation. Equations for polarisation and inversion, dispersion, saturation. Coherent and non-coherent pulse propagation. Optical solitons. Photon echo. Superradiation. Amplified spontaneous emission Lasers without optical resonator.			
12LTB2	Laser Technique 2	Z,ZK	3
Laser oscillator, the rate equation, the laser amplifier, Q-switching, mode-locking			
12MOF	Molecular Physics	ZK	2
Basic ideas on physics of molecules and molecular matter, and on structure-to-physical properties relationship. Methods of molecular structure determination.			
12MPP1	Microprocessor Laboratory 1	KZ	4
Become acquainted with a development board based on PIC16F873A and PIC16F877A microcontrollers, development environment MPLAB X IDE, PRESTO programmer, ASIX UP program, and PICkit3 debugger. Programming in assembly and C language for microcontrollers. Basic operations with microcontroller modules.			
12MPP2	Microprocessor Laboratory 2	KZ	4
Learning to use more PIC16F877A internal modules on PVK40 development board: PWM module (Capture/Compare), parallel communication interface (controlling character LCD device), serial communication interface USART, serial communication interface I2C/SPI, microcontroller PIC18F45K20. Programming in C language for microcontrollers.			
12MPR1	Microprocessors 1	ZK	4
Microprocessor and microcomputer, microprocessor types, memory types CPU, memory, Input output. Code and data, addressing modes(direct, indirect, register, relative,..., stack memory, procedure calls, IO devices - program control, interrupt. Microprocessor Microchip PIC16F877A, Instruction codes- Assembler and Macroassembler, programming languages. RISC processors - principles			
12MPR2	Microprocessors 2	ZK	2
Architecture IA-32. Data types and addressing. Memory segmentation and paging. Real and privileged mode. Instruction set, Assembler. description.			
12NT	Nanotechnology	ZK	2
Lectures will introduce students mainly to modern technological methods of preparation of semiconductor, metal and dielectric nanostructures. Physical and chemical fundaments of different technologies (MBE, MOVPE, EBL, sol-gel and colloidal solution) will be explained. Substantive attention will be devoted to epitaxial technologies which are substantial for nanostructure preparation. Particular emphasis will be focused on detail characterization of "in situ" and "ex situ" techniques, their applications for heterostructure and nanostructure growths will be discussed as well. Some supportive technical methods - lithography, diffusion, evaporation, ion implantation, contact and dielectric layer preparation will be mentioned as well as soldering and encasement.			
12OSY	Operating Systems	ZK	3
Operating systems kernel, memory management, process, multitasking, interprocess communication, input/output, drivers, queues, client-server, internet communication, Multilanguage environment, user interface, system security, open systems.			
12UFN	Introduction to Photonics and Nanostructures	KZ	3
Overview of nanostructures and nanotechnologies; quantum technologies; quantum nanostructures; photonic structures; nanophotonics and nanoplasmonics; optical waveguides and fibers; integrated photonics; computer simulations; technological realization; student presentations			
12VFT	High Frequency and Impulse Circuitry	Z,ZK	2
The goals of course is to collect advanced knowledge in high frequency technics and high speed events. The course is focused on Maxwell equation solution, Gunn's diodes, high frequency technics, microwaves guidelines, striplines, oscillators, amplifiers and pulse generators.			
12VTV	Scientific and Technical Computing	Z	2
The students get familiar with methods of solving of computational problems in the scientific and technical practice, and with methods of their programming. The course is oriented mainly to programming in the Fortran language.			
12YAPL	Application of Lasers	Z,ZK	2
Application of lasers in industrial technologies, medicine, remote sensing, energetics, telecommunication, military, entertainment and other branches.			
12YNME1	Numerical Methods 1	Z,ZK	4
The course explains the basic principles of numerical mathematics important for numerical solving of problems important for physics and technology. Methods for solution of tasks very important for physicists (ordinary differential equations, random numbers) are included in addition to the basic numerical methods. Integrated computational environment MATLAB is used as a demonstration tool. The seminars are held in computer laboratory.			
12YPAS	Computer Algebra Systems	Z	2
Practically oriented introduction to computer algebra systems (CAS): their main characteristics, ways and means of using them. Constituent part is realized in computer classrooms: students acquire basic skills with CAS by solving relatively simple and basic tasks from mathematics and physics.			
12YRSEN	Control Systems and Sensors	Z,ZK	4
The lecture addresses the theory, analysis, and implementation of linear analog and digital control systems, as well as sensors for various physical quantities. Part of the lecture is devoted to computer modeling and simulation using MATLAB, along with practical measurements conducted by the students on a continuous system with analog control (a servomechanism with an electric motor) or a continuous system with discrete control (temperature control using a thermoelectric cooler module).			

12YULTB	Introduction to Laser Technique	KZ	3
Overview of electromagnetic radiation sources; laser principle; classification of lasers; characterization and rough application of various types of lasers; laser safety precautions. The laser amplifier, Q-switching, mode-locking.			
12YUNXAP	Introduction to UNIX	Z	2
Computer and operating systems. Personal computer, workstation and supercomputers. Processor, memory, bus, devices, hard disk, network interface. Hardware and software. Principles of operating systems. Operating system UNIX. Basic principles, kernel, kernel services. Documentation. File system, file atributes, working with files. Text editors: vi, emacs. Command interpreter (shell) bash and its programming (scripts). Controlling processes, process status, computer load a process priorities. Standard tools. Computer networks. Local computer networks. Global computer networks. Addresses and protocols TCP/IP. Network configutation of a computer. Network services: hardware sharing, mail, scp, etc. Network applications			
12YUVP	Introduction to Scientific Computing	Z	2
Practically oriented Introduction to scientific computing. Constituent part of the course is realized in computer classroom.Students get acquinted with some basic tools fort scientific and technicval computing, data analysis, data visualisation and algorithm development.			
12YVKT	Vacuum Technology	KZ	4
Rarefied gasses: basic concepts and relations; diffusion,flow of rarefied gases. Flow and current of gas, conductivity. Interaction of gas with solid surface; sorption, desorption; gas transport through solid matter; evaporation, condensation;Vacuum generation: Pumping proces, Ultimative pressure, Pumping speedPumps and their properties:-Positive displacement pumps: Diaphragm, Sliding vane rotary, Diffusion, Molecular, Roots, Molecular and Turbomolecular pumps. Sorption pumps: Cryopumps, Cryo-Adsorption pumps, Sublimation and NEG pumps, Ion getter pumps..Vacuum measurements: vacuum gauges of total and partial pressure; pumping speed; gas flow, search for leaks. Materials and vacuum components and seals.Practical exercises.			
12YVPMF	Selected Topics in Modern Physics	Z	3
The aim of this course is to improve students knowledge in modern parts of physics (such as measuring of gravitational waves, neutrinos, discovery of Higgs boson, principles of light emitting diodes, ...) with a partial help of computer algebra systems (e.g. Maple). Apart from the other courses related to modern physics taught in this study program, this course does not deal with detailed mathematical formalism of studied phenomena. Therefore, the secondary aim is the increase of students motivation for deeper understanding of modern physics and its laws in their following study			
12YZAOP	Fundamentals of Optics	Z,ZK	2
The lecture covers the very basics of optics - electromagnetic theory, linear optical physics and material effects, basics of nonlinear effects, and geometrical optics. The main goal of the lecture is to obtain, on the bachelor level, broad and general information on optics, giving an essential orientation in the field, especially with respect to character of the bachelor work. Particular topics are further elaborated during departmental masters program. The lecture stems from the electrodynamic notion of plane waves in vacuum (including polarization effects), and further from material medium. It explains basics of linear and nonlinear response in material medium and dispersion properties. It next informs on consequences in anisotropic media, it explains processes induced by boundary conditions at interfaces. It also discusses the consequences of statistics on interference processes, explains elements of two-wave interference and their applications in interferometers. Based on the Fresnel diffraction integral, diffraction processes are presented in a graphical form, including fundamentals of grating diffraction. Based on this diffraction principle, basic functioning of holography is clarified. Finally, the lecture unravels the geometrical optics limit. It takes notice on geometrical approach imaging, substitutive schema of a paraxial imaging system, and optical aberrations. It shows fundamentals of imaging in optical instruments.			
12YZELD	Fundamentals of Electrodynamics	Z,ZK	2
Subject starts by derivation of Maxwell-Lorentz microscopic equations followed by transition to Maxwell macroscopic theory. Using special theory of relativity formulae are found for transformation of field vectors between two inertial systems of coordinates with appropriate invariants. Wave and Helmholtz equations are derived. By expansion into plane monochromatic waves methods of solving these equations are studied in homogeneous media with gradually increasing complexity: isotropic without losses, with absoption, with dispersion, and non-isotropic. Finally, solution in weakly non-homogeneous madia is presented using the method of eiconal. Individual chapters are illustrated by appropriate examples.			
12YZFP	Principles of Plasma Physics	Z,ZK	4
Basic physics of high temperature plasmas is explained using particle, kinetic and fluid approaches. It includes drift motions and adiabatic invariants, linear theory of waves in plasmas and propagation of electromagnetic waves in inhomogeneous plasmas. Basic non-linear effects, such as ponderomotive force, self-focusing and parametric instabilities are explained. It comprises brief introduction into magnetohydrodynamics and nuclear fusion. Basics of atomic physics od multiply-ionized plasmas are introduced.			
12YZFS	Fundamentals of Photonic Structures	Z,ZK	2
The lecture covers the basics of photonic structures, it classifies photonic structures compares them with the electronic structures, summarizes their preparation and characterization. Specifically, the lecture discusses the basic physics and technology of optical waveguides; it introduces basic linear, nonlinear, and active structures of integrated photonics for applications in optical communications and sensors. Next, the attention is given to introduction of plasmonic structures and plasmonics, periodic structures and photonic crystals, metamaterials, metasurfaces, and finally to photonic structures for quantum technologies. Finally, the lecture is closed with student presentations on selected relevant topics and excursions to selected photonic laboratories.			
12YZMDT	Measurement and Data Processing	Z,ZK	2
Basic knowledge for the measurements and data processing and result interpretation: errors, precision, accuracy, normal distribution and its propeties, data fitting, separation of the signal from the noise.			
12YZPLT	Basic Laser Technique Laboratory	KZ	6
Lasers, solid state Nd:YAG laser, laser crystal, laser discharge lamp, laser cavity, resonator, free-running, Q-switching, laser amplifier. second harmonic, He-Ne glow discharges, laser diode, diode pumped Nd:YAG laser, CO2 laser marking, laser materials properties, non-linear transmission, laser beam transverse profile, acousto-optic modulators.			
12YZPOP	Basic Optical Laboratory	KZ	6
The practical laboratories give advanced practical skills by experimental work in optics and optoelectronics. Laboratory records must be elaborated.			
12ZEL1	Basic Electronics 1	Z,ZK	3
The subject provides primary knowledge of circuit theory concerning principles of electronic circuits in both stationary and harmonic stable state. Circuit analysis methods for linear circuits include symbolic and complex method are explained. Proper circuit analysis is also lectured. The subject's final part deals with transient effects inside linear circuits.			
12ZEL2	Basic Electronics 2	Z,ZK	3
The subject follows up with the Basic Electronics 1. Semiconductor elements basic properties are explained. Thecourse's final part deals with basic themes of logical circuits field.			
12ZFD	Physics Data Visualization	KZ	2
Vector graphics basics, scientific plots, dala visualization basics, measurements results presentation			
14YELM	Electron Microscopy	KZ	2
Abstract: In this course the students are introduced to the microscopic methods used for the characterization of materials, thin layers or nanoparticles. The introductory part is dedicated to the analogy of light and electron microscopy and to various types of microscopes. An important part of the course is given to the interaction of different types of radiation with matter, mathematical formulations and tools used in microscopy and to the description of particular parts of the microscopes. Introduction to kinematic and dynamic theory of diffraction, types of contrast, and diffraction and imaging techniques are also covered. A particular attention is given to analytical methods and imaging techniques in atomic resolution.			
14YTED	Creating Electronic Documents	Z	2
Basic skills for creating and presenting student theses. Individual exercises focus on creating and formatting texts, equations, charts, tables, presentations and entire documents in an office suite.			

15CH2	General Chemistry 2	Z,ZK	3
The course is taught only in the Czech language. The subject is the continuation of the course General chemistry I. The main attention is paid to general principles governing chemical processes. Using various examples, the fact that the validity of these principles is not restricted only to chemical processes is documented. The significance and practical use of explained principles are illustrated by examples solved in exercises.			
15YCH1	General Chemistry 1	Z	3
The most important concepts, quantities and units used in chemistry are introduced in the course General Chemistry I. Their significance and practical use are illustrated by examples solved in exercises.			
18YPRC1	Programming in C++ 1	Z	4
This course covers mainly the C programming language and non-object oriented features of the C++ language.			
18YPRC2	Programming in C++ 2	KZ	4
This course covers the object oriented programming and othesr advanced constructs in the C+;+ programming language and the Standard Template Library.			
18YZALG	Basics of Algorithmization	Z,ZK	4
This course is devoted to selected algorithms and methods for algorithm design. This course intruduces selected methods for the determination of the algorithm complexity.			
18YZPRO	Basics of Programming	Z	4
This course is intended mainly for students with little or no experience in programming. It familiarizes the students with the basic concepts in programming and with the Python programming language.			
TV-1	Physical Education	Z	1
TV-2	Physical Education	Z	1
TV-3	Physical education	Z	1
TV-4	Physical education	Z	1

For updated information see http://bilakniha.cvut.cz/en/FF.html
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