Study plan

Name of study plan: Bc Laser Technology and Instrumentation

Faculty/Institute/Others:
Department: Department of Physical Electronics
Branch of study guaranteed by the department: Laser and Instruments Technology
Garantor of the study branch: prof. Ing. Ivan Procházka, DrSc.
Program of study: Applications of Natural Sciences
Type of study: Bachelor full-time
Required credits: 166
Elective courses credits: 14
Sum of credits in the plan: 180
Note on the plan:

Name of the block: Compulsory courses of the specialization
Minimal number of credits of the block: 166
The role of the block: PO

Code of the group: BSLPTPP1
Name of the group: BSLPT - povinné předměty 1. ročník
Requirement credits in the group: In this group you have to gain at least 51 credits
Requirement courses in the group: In this group you have to complete at least 17 courses
Credits in the group: 51
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
02ELMA	**Electricity and Magnetism** *Goce Chadzitaskos, Josef Schmidt, Jiří Hrivnák, David Břeň Jiří Hrivnák (Gar.)*	Z,ZK	6	4+2	L	PO
12INF0	**Informatics 0** *Josef Blažej Josef Blažej (Gar.)*	KZ	2	2	Z	PO
01LALB	**Linear Algebra B 1, Examination** *Petr Ambrož, Lubomíra Dvořáková **Lubomíra Dvořáková** Petr Ambrož (Gar.)*	ZK	3	-		PO
01LAB2	**Linear Algebra B2** *Petr Ambrož Petr Ambrož (Gar.)*	Z,ZK	4	1+2	L	PO
01LAL	**Linear Algebra 1** *Lubomíra Dvořáková **Lubomíra Dvořáková** Lubomíra Dvořáková (Gar.)*	Z	2	2P+2C		PO
01MANB	**Calculus B 1, Examination** ***Matěj Tušek***	ZK	4	-		PO
01MAB2	**Calculus B2** *Severin Pošta, Edita Pelantová Severin Pošta (Gar.)*	Z,ZK	7	2+4	L	PO
01MAN	**Calculus 1** *Severin Pošta, Edita Pelantová **Severin Pošta** Severin Pošta (Gar.)*	Z	4	4+4		PO
01MATZ1	**Mathematics, Examination 1** *Radek Fučík **Matěj Tušek** Radek Fučík (Gar.)*	ZK	2	-	Z	PO
01MATZ2	**Mathematics, Examination 2** *Radek Fučík, Matěj Tušek **Matěj Tušek** Radek Fučík (Gar.)*	ZK	2	-	L	PO
01MAT1	**Mathematics 1** *Radek Fučík Radek Fučík (Gar.)*	Z	4	6	Z	PO
01MAT2	**Mathematics 2** *Radek Fučík Radek Fučík (Gar.)*	Z	4	6	L	PO
02MECH	**Mechanics** *David Břeň, Antonín Hoskovec David Břeň (Gar.)*	Z	4	4+2	Z	PO
02MECHZ	**Mechanics - Examination** *Goce Chadzitaskos, David Břeň, Antonín Hoskovec, Filip Petrásek, Stanislav Skoupý **Antonín Hoskovec** David Břeň (Gar.)*	ZK	2	-	Z	PO
12EPR1	**Electronics Practicum 1** *Ivan Procházka, Jaroslav Pavel Ivan Procházka (Gar.)*	KZ	3	0+2	Z	PO
12EPR2	**Electronics Practicum 2** *Ivan Procházka Ivan Procházka (Gar.)*	KZ	3	0+2	L	PO
00PT	**Preparatory Week** *Michal Beneš **Michal Beneš** Michal Beneš (Gar.)*	Z	2	týden	Z	PO

12ULT	**Introduction to Laser Technique** *Jan Šulc, Helena Jelínková Jan Šulc (Gar.)*	Z,ZK	3	2+1	Z	PO
12VTV	**Scientific and Technical Computing** *Ivan Procházka Ivan Procházka (Gar.)*	Z	2	1+1	L	PO
12ZEL1	**Basic Electronics 1** *Jaroslav Pavel Jaroslav Pavel (Gar.)*	Z,ZK	3	2+1	Z	PO
12ZEL2	**Basic Electronics 2** *Jaroslav Pavel Jaroslav Pavel (Gar.)*	Z,ZK	3	2+1	L	PO
16ZPSP	**Basic Work with PC** ***Tereza Hanušová*** *Tomáš Vrba (Gar.)*	Z	2	0+2	1	PO
18ZPRO	**Basics of Programming** *Vladimír Jarý, Zdeněk Čulík, Miroslav Virius, Lucie Roškotová, Aleš Suchomel, František Voldřich, Jan Thiele* ***Miroslav Virius***	Z	4	2P+2C	Z	PO

Characteristics of the courses of this group of Study Plan: Code=BSLPTPP1 Name=BSLPT - povinné předměty 1. ročník

02ELMA	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			
12INF0	Informatics 0	KZ	2
Vector graphics basics, scientific plots, dala visualization basics, measurements results presentation			
01LALB	Linear Algebra B 1, Examination	ZK	3
01LAB2	Linear Algebra B2	Z,ZK	4
The subject summarizes the most important notions and theorems related to the matrix theory, to the study of vector spaces with a scalar product and to the linear geometry.			
01LAL	Linear Algebra 1	Z	2
01MANB	Calculus B 1, Examination	ZK	4
Examination of knowledge about stuff lectured in the 01MAN course.			
01MAB2	Calculus B2	Z,ZK	7
Basic calculus (real analysis, indefinite and definite integrals and series).			
01MAN	Calculus 1	Z	4
Basic calculus (real analysis, functions of one real variable, differential calculus).			
01MATZ1	Mathematics, Examination 1	ZK	2
01MATZ2	Mathematics, Examination 2	ZK	2
01MAT1	Mathematics 1	Z	4
The course is devoted to the study of the basics of calculus of one variable. It includes an introduction to differential and integral calculus, with particular emphasis on applications in practical problems.			
01MAT2	Mathematics 2	Z	4
The course, which is the continuation of Mathematics 1, is devoted to the integration techniques, improper Riemann integral, introduction to parametric curves (especially in polar coordinates), the basics of sequences and infinite series, and finally to the Taylor and power series and their applications.			
02MECH	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.			
02MECHZ	Mechanics - Examination	ZK	2
The content of the subject is the examination according to the plan of studies.			
12EPR1	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	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.			
00PT	Preparatory Week	Z	2
12ULT	Introduction to Laser Technique	Z,ZK	3
Overview of electromagnetic radiation sources; laser principle; classification of lasers; characterization and rough application of various types of lasers; laser safety precautions.			
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.			
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.			
16ZPSP	Basic Work with PC	Z	2
The aim of the subject is to teach basic skills associated with a personal computer. The introductory part of the course is devoted to information systems and resources available to the CTU and PNSPE students. Another part summarizes basic information about computer hardware, software and security. Most of the course is devoted to exercises whose aim is to teach students to use office software (word processor, spreadsheet, presentation software) at a level that is required in other courses of study (practice, undergraduate thesis, research and thesis).			
18ZPRO	Basics of Programming	Z	4
This lecture 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 C++programming language.			

Code of the group: BSLPTPP2

Name of the group: BSLPT - povinné předměty 2. ročník
Requirement credits in the group: In this group you have to gain at least 73 credits
Requirement courses in the group: In this group you have to complete at least 18 courses
Credits in the group: 73
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
12BFY3	**Physics 3** *Milan Šiňor Milan Šiňor (Gar.)*	Z,ZK	4	3+1	Z	PO
12BFY4	**Physics 4** *Milan Šiňor Milan Šiňor (Gar.)*	Z,ZK	4	3+1	L	PO
02PRA1	**Experimental Laboratory 1** *Libor Škoda, Katarína Křížková Gajdošová, Barbara Antonina Trzeciak, Jaroslav Bielčík Jaroslav Bielčík (Gar.)*	KZ	6	0+4	Z	PO
02PRA2	**Experimental Laboratory 2** *Libor Škoda, Jaroslav Bielčík* ***Jaroslava Óbertová*** *Jaroslav Bielčík (Gar.)*	KZ	6	0+4	L	PO
12IPG	**Internet and Computer Literacy** *Josef Blažej, Antonín Novotný Josef Blažej (Gar.)*	Z	2	2+0	L	PO
12LT1	**Laser Technique 1** *Helena Jelínková Helena Jelínková (Gar.)*	Z,ZK	3	2+1	Z	PO
12LT2	**Laser Technique 2** *Jan Šulc, Václav Kubeček Václav Kubeček (Gar.)*	Z,ZK	2	2+0	L	PO
01MAB3	**Calculus B3** *Milan Krbálek Milan Krbálek (Gar.)*	Z,ZK	7	2+4	Z	PO
01MAB4	**Calculus B4** *Milan Krbálek, Václav Klika Milan Krbálek (Gar.)*	Z,ZK	7	2+4	L	PO
01MAT3	**Mathematics 3** *Leopold Vrána* ***David Krejčiřík*** *Leopold Vrána (Gar.)*	Z,ZK	4	2+2	Z	PO
01MAT4	**Mathematics 4** *Matěj Tušek Matěj Tušek (Gar.)*	Z,ZK	4	2+2	L	PO
12MPP1	**Microprocessor Laboratory 1** *David Vyhlídal (Gar.)*	KZ	4	0+3	Z	PO
12MPP2	**Microprocessor Laboratory 1** *David Vyhlídal (Gar.)*	KZ	4	0+3	L	PO
12MPR1	**Microprocessors 1** *Miroslav Čech Miroslav Čech (Gar.)*	ZK	4	4+0	Z	PO
12MPR2	**Microprocessors 2** *Miroslav Čech Miroslav Čech (Gar.)*	ZK	2	2+0	L	PO
12NME1	**Numerical Methods 1** *Pavel Váchal, Jiří Limpouch* ***Jiří Limpouch*** *Jiří Limpouch (Gar.)*	Z,ZK	4	2+2	L	PO
12ROPR1	**Annual Project 1** *Josef Blažej, Ivan Procházka, Václav Kubeček Ivan Procházka (Gar.)*	Z	4	0+3	Z	PO
12ROPR2	**Annual Project 2** *Josef Blažej Ivan Procházka (Gar.)*	Z	8	0+5	L	PO
12ZPLT	**Basic Laser Technique Laboratory** *Josef Blažej, Václav Kubeček Václav Kubeček (Gar.)*	KZ	6	0+4	L	PO
12ZELD	**Fundamentals of Electrodynamics** *Milan Šiňor Ivan Richter (Gar.)*	Z,ZK	2	2+0	Z	PO
12ZAOF	**Fundamentals of Optical Physics**	Z,ZK	4	4+0	Z	PO
12ZAOP	**Fundamentals of Optics** *Ivan Richter, Pavel Kwiecien Ivan Richter (Gar.)*	Z,ZK	2	2+0	Z	PO
12ZMD	**Measurement and Data Processing** *Ivan Procházka Ivan Procházka (Gar.)*	KZ	2	1+1	Z	PO

Characteristics of the courses of this group of Study Plan: Code=BSLPTPP2 Name=BSLPT - povinné předměty 2. ročník

12BFY3	Physics 3	Z,ZK	4

Částicové vlastnosti vln. Vlnové vlastnosti částic. Struktura atomu. Bohrův model atomu. Schrödingerova rovnice. Základní řešení Schrödingerovy rovnice. Kvantová teorie atomu vodíku. Víceelektronové atomy. Atomová spektra. Chemická vazba. Struktura molekul. Molekulová spektra.

12BFY4	Physics 4	Z,ZK	4

Introduction to Thermodynamics, Statistical physics, Solid state physics fundamentals, Plasma physics fundamentals.

02PRA1	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.

02PRA2	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.

12IPG	Internet and Computer Literacy	Z	2
The repetitorium of principles of computer networks. Introduction to CTU network specifics, Czech computer-focus law. Poster as a tool for knowledge presentation.			
12LT1	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.			
12LT2	Laser Technique 2	Z,ZK	2
Laser oscillator, the rate equation, the laser amplifier, Q-switching, mode-locking			
01MAB3	Calculus B3	Z,ZK	7
The course is devoted to functional sequences and series, theory of ordinary differential equations, theory of quadratic forms and surfaces, and general theory of metric spaces, normed and prehilbert?s spaces.			
01MAB4	Calculus B4	Z,ZK	7
The course is devoted properties of functions of several variables, differential and integral calculus. Furthermore, the measure theory and theory of Lebesgue integral is studied.			
01MAT3	Mathematics 3	Z,ZK	4
The subject summarises the most important notions and theorems related to the study of finite-dimensional vector spaces.			
01MAT4	Mathematics 4	Z,ZK	4
Linear and non-linear differential equations of the first order. Linear differential equations of higher order with constant coefficients. Multivariable calculus and its applications.			
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 1	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			
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.			
12NME1	Numerical Methods 1	Z,ZK	4
There are explained 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 principle programming language as a demonstration tool. The seminars are held in computer laboratory.			
12ROPR1	Annual Project 1	Z	4
Individual work on solving of a problem. In the winter semester, it has character of a background research, in the summer semester, student's own contribution to the problem solution is expected. Basics of independent work on the problem solution, public presentation of the progress of the solution, presentation in a foreign language, protocol elaboration, work with literature, references and citations.			
12ROPR2	Annual Project 2	Z	8
Individual work on solving of a problem. In the winter semester, it has character of a background research, in the summer semester, student's own contribution to the problem solution is expected. Basics of independent work on the problem solution, public presentation of the progress of the solution, presentation in a foreign language, protocol elaboration, work with literature, references and citations.			
12ZPLT	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.			
12ZELD	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.			
12ZAOF	Fundamentals of Optical Physics	Z,ZK	4
The lecture covers the very basics of optics. Namely, electromagnetic theory, linear optical physics and material effects, basics of nonlinear approach, and geometrical optics. The main goal of the lecture is to provide broad and general information on optics for the bachelor level students. The scope of the lecture gives 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 also 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 graphical form, including fundamentals of grating diffraction. Based on this diffraction principle, basic principles of holography are clarified. Finally, the lecture unravels the geometrical optics limit. It takes notice on geometrical approach imaging, substitutive scheme of a paraxial imaging system, and optical aberrations. It shows fundamentals of imaging in optical instruments.			
12ZAOP	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.			
12ZMD	Measurement and Data Processing	KZ	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: BSLPTPP3

Name of the group: BSLPT - povinné předměty 3. ročník
Requirement credits in the group: In this group you have to gain at least 42 credits
Requirement courses in the group: In this group you have to complete at least 12 courses
Credits in the group: 42
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
12AUX	**Administration of UNIX System** *Milan Šiňor Milan Šiňor (Gar.)*	KZ	2	2+0	L	PO
12APL	**Application of Lasers** *Helena Jelínková, Alexandr Jančárek Helena Jelínková (Gar.)*	Z,ZK	2	2+0	Z	PO
12BPLA1	**Bachelor Thesis 1** *Václav Kubeček Václav Kubeček (Gar.)*	Z	5	0+5	Z,L	PO
12BPLA2	**Bachelor Thesis 2** *Václav Kubeček Václav Kubeček (Gar.)*	Z	10	0+10	L,Z	PO
12LAS	**Laser Systems** *Václav Kubeček Václav Kubeček (Gar.)*	Z,ZK	3	2+1	L	PO
12OSY	**Operating Systems** *Miroslav Čech Miroslav Čech (Gar.)*	ZK	3	3+0	Z	PO
12OPK	**Optics Communications** *Josef Blažej, Anton Kuchar Josef Blažej (Gar.)*	ZK	2	2+0	Z	PO
12OPEL	**Optoelectronics** *Jiří Čtyroký Jiří Čtyroký (Gar.)*	Z,ZK	2	2	L	PO
12RSEN	**Control Systems and Sensors** *David Vyhlídal Ivan Procházka (Gar.)*	Z,ZK	4	4	Z	PO
12SBA1	**Bachelor Seminar 1** *Josef Blažej Josef Blažej (Gar.)*	Z	1	0+1	Z	PO
12SBA2	**Bachelor Seminar 2** *Josef Blažej Josef Blažej (Gar.)*	Z	2	0+2	L	PO
12ZPOP	**Basic Optical Laboratory** *Alexandr Jančárek Alexandr Jančárek (Gar.)*	KZ	6	0+4	L	PO

Characteristics of the courses of this group of Study Plan: Code=BSLPTPP3 Name=BSLPT - povinné předměty 3. ročník

12AUX	Administration of UNIX System	KZ	2
Basic and more advanced administration of Unix operating system			
12APL	Application of Lasers	Z,ZK	2
Application of lasers in industrial technologies, medicine, remote sensing, energetics, telecommunication, military, entertainment and other branches.			
12BPLA1	Bachelor Thesis 1	Z	5
The course concerns the topic, given by the bachelor work supervisor. The successful defense of the bachelor thesis is the integral part of the particular bachelor curriculum, depending on the specialization. The bachelor work submission is agreed upon by the departmental head and the faculty dean. A student pursues the background research, based on journal, internet as well as special book literature, given by the bachelor work advisor, included in the official bachelor work submission, and further independently searched out by the student. With a supervisor agreement, the student further solves given particular problems, based on the studied and recommended literature sources. The thesis is reviewed by one (typically internal) reviewer who is an expert in the field. Contact hours represent individual communications with the bachelor work advisor where current needs are discussed and solved. The course is thus not regularly scheduled.			
12BPLA2	Bachelor Thesis 2	Z	10
The course concerns the topic, given by the bachelor work supervisor. The successful defense of the bachelor thesis is the integral part of the particular bachelor curriculum, depending on the specialization. The bachelor work submission is agreed upon by the departmental head and the faculty dean. A student pursues the background research, based on journal, internet as well as special book literature, given by the bachelor work advisor, included in the official bachelor work submission, and further independently searched out by the student. With a supervisor agreement, the student further solves given particular problems, based on the studied and recommended literature sources. The thesis is reviewed by one (typically internal) reviewer who is an expert in the field. Contact hours represent individual communications with the bachelor work advisor where current needs are discussed and solved. The course is thus not regularly scheduled.			
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.			
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.			
12OPK	Optics Communications	ZK	2
Basics on signal transmission over optical fibres in communication networks. Sources and detectors of infrared radiation for optical communication. Transmission properties of optical fibres. Single channel optical fibre links. Signal multiplexing. Multiple channel optical fibre links. Coherent optical communication. Optical signal switching. Optical fibre networks. Services in electronic communication networks. Trends in development of information systems using optical fibre networks for signal transmission.			
12OPEL	Optoelectronics	Z,ZK	2
Physics and technology of optical fibre and p[lanar waveguides, fibre amplifiers and lasers. Photonic integration. Photonic crystals and plasmonics. Applications in optical communication and sensors.			
12RSEN	Control Systems and Sensors	Z,ZK	4
The lecture addresses the theory, analysis and implementation of linear analog and digital control systems and sensors for several physical quantities. The part of the lecture is devoted to computer modeling and simulation using MATLAB and practical measurements on a continuous system with analog control (servomechanism with electrical motor) or continuous system with discrete control (temperature control using thermoelectric cooler module) performed by the students.			

12SBA1	Bachelor Seminar 1	Z	1
Literature overview, Theoretical Background and practical work, Project presentation.			
12SBA2	Bachelor Seminar 2	Z	2
Literature overview, Theoretical background and practical work, Project presentation, Defence preparation			
12ZPOP	Basic Optical Laboratory	KZ	6
The practical laboratories give advanced practical skills by experimental work in optics and optoelectronics. Laboratory records must be elaborated.			

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: BSJAZYKY
Name of the group: BS - jazyky
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
04AMZK	**English for Intermediate Students Examination** *Hana Čápová, Jana Kovářová* ***Jana Kovářová*** *Hana Čápová (Gar.)*	ZK	4		Z	PV
04APZK	**English for Advanced Students Examination** *Kevin Patrick Joseph Glanville, Beatriz Vadillo Gonzalo*	ZK	5		Z	PV
04CESMZK	**Czech for Intermediate Students Examination** *Jana Kovářová* ***Jana Kovářová*** *Jana Kovářová (Gar.)*	ZK	4		Z	PV
04CESPZK	**Czech for Foreign Students - Advanced Examination** *Jana Kovářová* ***Jana Kovářová*** *Jana Kovářová (Gar.)*	ZK	5		Z	PV
04FMZK	**French for Intermediate Students Examination** *Věra Šlechtová Věra Šlechtová (Gar.)*	ZK	4		Z	PV
04FPZK	**French for Intermediate Students Examination** *Věra Šlechtová Věra Šlechtová (Gar.)*	ZK	5		Z	PV
04FZZK	**French for Beginners Examination** *Věra Šlechtová Věra Šlechtová (Gar.)*	ZK	3		L	PV
04NMZK	**German for Intermediate Students Examination** *Miloslava Čechová Miloslava Čechová (Gar.)*	ZK	4		Z	PV
04NPZK	**German for Advanced Students Examination** *Miloslava Čechová Miloslava Čechová (Gar.)*	ZK	5		Z	PV
04RMZK	**Russian for Intermediate Students Examination** *Zhanna Isaeva Zhanna Isaeva (Gar.)*	ZK	4		Z	PV
04RPZK	**Russian for Intermediate Students Examination** *Zhanna Isaeva Zhanna Isaeva (Gar.)*	ZK	5		Z	PV
04RZZK	**Russian for Beginners Examination** *Zhanna Isaeva*	ZK	3		L	PV
04SMZK	**Spanish for Intermediate Students Examination** *Beatriz Vadillo Gonzalo Beatriz Vadillo Gonzalo (Gar.)*	ZK	4		Z	PV
04SPZK	**Spanish for Advanced Students Examination** *Beatriz Vadillo Gonzalo Beatriz Vadillo Gonzalo (Gar.)*	ZK	5		Z	PV
04SZZK	**Spanish for Beginners Examination** *Jana Kovářová, Beatriz Vadillo Gonzalo Beatriz Vadillo Gonzalo (Gar.)*	ZK	3		L	PV

Characteristics of the courses of this group of Study Plan: Code=BSJAZYKY Name=BS - jazyky

04AMZK	English for Intermediate Students Examination	ZK	4
The course content is the examination as given by the study plan. The examination covers the 04AM1, 04AM2, and 04AM3 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.			
04APZK	English for Advanced Students Examination	ZK	5
The course content is the examination as given by the study plan. The student is supposed to demonstrate mastering the 04AP3 syllabus and the ability to apply their knowledge obtained in the three 04AP courses. The examination consists of 2 parts - written (110 min) and oral (30 min) and includes also oral presentation of a topic from the student´s field of study.			
04CESMZK	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 04CESM1,2,3 courses and can only be taken after successful completion of the 3 courses. Detailed information is to be obtained from the teacher.			
04CESPZK	Czech for Foreign Students - Advanced Examination	ZK	5
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 04CESP1,2,3 courses and can only be taken after successful completion of the 3 courses. Detailed information is to be obtained from the teacher.			
04FMZK	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.			

04FPZK	French for Intermediate Students Examination	ZK	5
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.			
04FZZK	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.			
04NMZK	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 04NM1 - 04NM3. 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.			
04NPZK	German for Advanced Students Examination	ZK	5
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 04NM1 - 04NM3. 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.			
04RMZK	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.			
04RPZK	Russian for Intermediate Students Examination	ZK	5
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.			
04RZZK	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.			
04SMZK	Spanish for Intermediate Students Examination	ZK	4
The course content is the examination as given by the study plan. 04SMZK examination consists of two parts - written and oral; to be eligible for the written part, students will have obtained non-graded assessment for course 04SM3.Oral examination follows the written part.			
04SPZK	Spanish for Advanced Students Examination	ZK	5
The course content is the examination as given by the study plan. Examination 04SPZK 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 SP1, SP2, and SP3 or on an individual study plan of the student.			
04SZZK	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. Student can register for oral examination only if he/she has 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: BSVOLPREDM
Name of the group: BS - volitelné předměty
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
12AUX	**Administration of UNIX System** *Milan Šiňor Milan Šiňor (Gar.)*	KZ	2	2+0	L	v
01ALG	**Algebra** ***Pavel Šťovíček***	ZK	4	4+0	Z	v
01ALGE	**Algebra** *Zuzana Masáková* ***Zuzana Masáková*** *Zuzana Masáková (Gar.)*	Z,ZK	6	4+1		v
11ANEL	**Linear Circuit Analysis** *Pavel Jiroušek Pavel Jiroušek (Gar.)*	Z,ZK	4	4	Z	v
15CHEM	**Analytical Calculations and Chemometry Principals** *Jiří Zima Jiří Zima (Gar.)*	ZK	2	2+0	Z	v
04ABZK	**English - State Examination** *Hana Čápová, Jana Kovářová, Dunstan Clarke, Irena Dvořáková, Eliška Rafajová* ***Jana Kovářová*** *Eliška Rafajová (Gar.)*	ZK	5	2	L	v
04AM1	**English for Intermediate Students M1** ***Jana Kovářová*** *Hana Čápová (Gar.)*	Z	1	0+2	Z	v
04AM2	**English for Intermediate Students M2** ***Jana Kovářová*** *Hana Čápová (Gar.)*	Z	1	0+2	L	v
04AM3	**English for Intermediate Students M3** ***Jana Kovářová*** *Hana Čápová (Gar.)*	Z	1	0+2	Z	v
04AP1	**English for Advanced Students P1**	Z	1	0+2	Z	v
04AP2	**English for Advanced Students P2** *Dunstan Clarke (Gar.)*	Z	1	0+2	L	v

04AP3	**English for Advanced Students P3**	Z	1	0+2	Z	v
16APLB	**Application of Ionizing Radiation in Analytical Methods** ***Radek Fučík***	ZK	5	4+0	L	v
12APL	**Application of Lasers** *Helena Jelínková, Alexandr Jančárek Helena Jelínková (Gar.)*	Z,ZK	2	2+0	Z	v
11APLG	**Applications of Group Theory in Solid State Physics** *Zdeněk Potůček Zdeněk Potůček (Gar.)*	ZK	2	2	Z	v
02AMS	**Atomic and Molecular Spectroscopy** *Svatopluk Civiš* ***Svatopluk Civiš*** *Svatopluk Civiš (Gar.)*	Z,ZK	4	2+2	Z	v
04CESM1	**Czech for foreigners - Intermediate** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	1	0+2	Z	v
04CESM2	**Intermediate Czech 2** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	1	0+2	L	v
04CESM3	**Intermediate Czech 3** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	1	0+2	Z	v
04CESP1	**Czech for Foreign Students - Advanced Examination** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	1	0+2	Z	v
04CESP2	**Czech for Foreigners - Advanced** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	1	0+2	L	v
04CESP3	**Czech for Foreigners - Advanced** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	1	0+2	Z	v
15DALCH	**History of Alchemy and Chemistry** *Vladimír Karpenko Vladimír Karpenko (Gar.)*	ZK	2	2+0	Z	v
02DEF1	*Igor Jex, Miroslav Myška* ***Miroslav Myška*** *Igor Jex (Gar.)*	Z	2	2+0	Z	v
02DEF2	**History of Physics 2** *Igor Jex Igor Jex (Gar.)*	Z	2	2+0	L	v
01DEM	**History of Mathematics** *Lubomíra Dvořáková Lubomíra Dvořáková (Gar.)*	Z	1	0+2	L	v
02DRG	**Differential Equations, Symmetries and Groups** *Libor Šnobl* ***Jan Čepila*** *Libor Šnobl (Gar.)*	Z	4	2+2	Z	v
01DIM1	**Discrete Mathematics 1** *Zuzana Masáková* ***Zuzana Masáková*** *Zuzana Masáková (Gar.)*	Z	2	2+0	Z	v
01DIM2	**Discrete Mathematics 2** *Zuzana Masáková Zuzana Masáková (Gar.)*	Z	2	2+0	L	v
01DIM3	**Discrete Mathematics 3** *Lubomíra Dvořáková* ***Lubomíra Dvořáková*** *Lubomíra Dvořáková (Gar.)*	Z	2	2+0	Z	v
00EKOT	**Economy in Technology** ***Jana Kovářová***	Z	1	2+0		v
11ELEA	**Instrumentation and Measurement** *Pavel Jiroušek Pavel Jiroušek (Gar.)*	Z,ZK	2	2	L	v
14ELMI	**Electron Microscopy** *Miroslav Karlík, Petr Kopřiva* ***Miroslav Karlík*** *Miroslav Karlík (Gar.)*	Z,ZK	3	2+0		v
12EGS1	**English Graduate Standard 1** ***Ivan Procházka***	KZ	4	0+4	L	v
18ESPG1	**European Computer Driving Licence 1** *Zuzana Petříčková, Jaromír Kukal, Lucie Tylová*	Z	2	0+2	Z	v
18ESPG2	**European Computer Driving Licence 2** *Zuzana Petříčková*	Z	2	0+2	L	v
16EPAM	**Exact Methods in Research of Historic Monuments** *Ladislav Musílek Ladislav Musílek (Gar.)*	ZK	2	2+0	Z	v
02EXF1	**Experimental Physics 1** *Katarína Kŕížková Gajdošová Katarína Kŕížková Gajdošová (Gar.)*	Z	2	2+0	L	v
02EXF2	**Experimental Physics 2** *Katarína Kŕížková Gajdošová, Jaroslava Óbertová, Petr Chaloupka* ***Jaroslava Óbertová*** *Vojtěch Petráček (Gar.)*	ZK	2	2+0	Z	v
17ENF	**Experimental Neutron Physics** *Jan Rataj Jan Rataj (Gar.)*	KZ	2	2+1	L	v
04FM1	**French for Intermediate Students M1** *Věra Šlechtová (Gar.)*	Z	1	0+2	Z	v
04FM2	**French for Intermediate Students M2** *Věra Šlechtová (Gar.)*	Z	1	0+2	L	v
04FM3	**French for Intermediate Students M3** *Věra Šlechtová (Gar.)*	Z	1	0+2	Z	v
04FP1	**French for Advanced Students P1** *Věra Šlechtová (Gar.)*	Z	1	0+2	Z	v
04FP2	**French for Advanced Students P2** *Věra Šlechtová (Gar.)*	Z	1	0+2	L	v
04FP3	**French for Advanded Students P3** *Věra Šlechtová (Gar.)*	Z	1	0+2	Z	v
04FZ1	**French for Beginners Z1** *Věra Šlechtová (Gar.)*	Z	1	0+4	L	v
04FZ2	**French for Beginners Z2** *Věra Šlechtová (Gar.)*	Z	1	0+4	Z	v
04FZ3	**French for Beginners Z3** *Věra Šlechtová (Gar.)*	Z	1	0+4	L	v

04FZ4	**French for Beginners Z4** *Věra Šlechtová (Gar.)*	Z	1	0+4	Z	v
04FZ5	**French for Beginners Z5** *Věra Šlechtová (Gar.)*	Z	1	0+4	L	v
01FKP	**Functions of Complex Variable**	ZK	2	2+0	Z	v
01FKPB	**Functions of Complex Variable B**	Z	2	2+0	Z	v
01FAN1	**Functional Analysis 1** *Pavel Šťovíček* ***Pavel Šťovíček*** *Pavel Šťovíček (Gar.)*	Z,ZK	4	2+2		v
01FA1	**Functional Analysis 1** ***Pavel Šťovíček***	Z,ZK	3	2+1	Z	v
01FA2	**Functional Analysis 2** *Pavel Šťovíček Pavel Šťovíček (Gar.)*	Z,ZK	4	2+2	L	v
02PRA1	**Experimental Laboratory 1** *Libor Škoda, Katarína Křížková Gajdošová, Barbara Antonina Trzeciak, Jaroslav Bielčík Jaroslav Bielčík (Gar.)*	KZ	6	0+4	Z	v
02PRA2	**Experimental Laboratory 2** *Libor Škoda, Jaroslav Bielčík* ***Jaroslava Óbertová*** *Jaroslav Bielčík (Gar.)*	KZ	6	0+4	L	v
02FYS1	**Physical Seminar 1** *Vojtěch Svoboda (Gar.)*	Z	2	0+2	Z	v
02FYS2	**Physical Seminar 2**	Z	2	0+2	L	v
01GTDR	**Geometric Theory of Ordinary Differential Equations** *Michal Beneš Michal Beneš (Gar.)*	Z	2	0+2	Z	v
12INS1	**Information Systems 1** *Antonín Novotný Antonín Novotný (Gar.)*	Z,ZK	2	2	Z	v
12INS2	**Information Systems 2** *Antonín Novotný Antonín Novotný (Gar.)*	Z,ZK	2	2	L	v
16ZJTB	**Nuclear Energy Facilities and Accelerators** *Tomáš Čechák, Kamil Augsten Tomáš Čechák (Gar.)*	ZK	2	2+0	Z	v
17JARE	**Nuclear Reactors** *Tomáš Bílý, Pavel Suk, Ondřej Novák, Bedřich Heřmanský Bedřich Heřmanský (Gar.)*	ZK	2	2	L	v
01JEPR	**Simple Compilers** *Zdeněk Čulík Zdeněk Čulík (Gar.)*	Z	2	2	L	v
16KPR	**Clinical Propaedeutic** *Jana Votrubová* ***Jana Votrubová*** *Jana Votrubová (Gar.)*	ZK	2	2+0	Z	v
04AKS	**English Conversation** ***Jana Kovářová*** *Jana Kovářová (Gar.)*	Z	1	0+2	L	v
02KF	**Quantum Physics** *Filip Petrásek Libor Šnobl (Gar.)*	Z,ZK	3	2P+1C	Z	v
02LCF1	**Experimental Laboratory 1** ***Jaroslav Bielčík*** *Jaroslav Bielčík (Gar.)*	Z	2	0+2	Z	v
02LCF2	**Experimental Laboratory 2** ***Jaroslav Bielčík*** *Jaroslav Bielčík (Gar.)*	Z	2	0+2	L	v
12LT1	**Laser Technique 1** *Helena Jelínková Helena Jelínková (Gar.)*	Z,ZK	3	2+1	Z	v
12LT2	**Laser Technique 2** *Jan Šulc, Václav Kubeček Václav Kubeček (Gar.)*	Z,ZK	2	2+0	L	v
12LAS	**Laser Systems** *Václav Kubeček Václav Kubeček (Gar.)*	Z,ZK	3	2+1	L	v
01LIP	**Linear Programming** *Čestmír Burdík Čestmír Burdík (Gar.)*	Z,ZK	3	2+1	L	v
18MAK1	**Macroeconomics 1** *Quang Van Tran, Adam Borovička* ***Quang Van Tran***	Z,ZK	4	2+2	Z	v
18MAK2	**Macroeconomics 2** *Adam Borovička* ***Quang Van Tran***	Z,ZK	4	2+2	L	v
01MAPR	**Markov processes** *Jan Vybíral Jan Vybíral (Gar.)*	Z,ZK	4	2+2		v
18EKO1	**Mathematical Economics 1**	Z,ZK	5	2+2	Z	v
18EKO2	**Mathematical Economics 2**	Z,ZK	5	2+2	L	v
01MASC	**Mathematical Statistics - Seminar** *Tomáš Hobza* ***Tomáš Hobza*** *Tomáš Hobza (Gar.)*	Z	2	0+2		v
00MAM1	**Essentials of High School Course 1** *David Břeň* ***Jan Čepila***	Z	1	0+1		v
00MAM2	**Essentials of High School Math Course 2**	Z	1	0+1		v
01MMPV	**Mathematical Models of Groundwater Flow** *Jiří Mikyška Jiří Mikyška (Gar.)*	KZ	2	2+0	L	v
01MMF	**Methods of Mathematical Physics**	Z,ZK	6	4+2	L	v
18MIK1	**Microeconomics 1**	Z,ZK	5	2+2	Z	v
18MIK2	**Microeconomics 2**	Z,ZK	5	2+2	L	v
11MIK	**Logical Circuits and Microprocessors** *Pavel Jiroušek Pavel Jiroušek (Gar.)*	Z,ZK	4	4	L	v

12MPR1	**Microprocessors 1** *Miroslav Čech Miroslav Čech (Gar.)*	ZK	4	4+0	Z	v
12MPR2	**Microprocessors 2** *Miroslav Čech Miroslav Čech (Gar.)*	ZK	2	2+0	L	v
12MOF	**Molecular Physics** *Jan Proška, Martin Michl Jan Proška (Gar.)*	ZK	2	2+0	L	v
12NT	**Nanotechnology** *Jan Proška, Eduard Hulicius Eduard Hulicius (Gar.)*	ZK	2	2+0	Z	v
02NSAD	**Simulations and Data Analysis Tools** ***Jan Čepila***	Z	2	2+0		v
04NM1	**German for Intermediate Students M1** *Miloslava Čechová (Gar.)*	Z	1	0+2	Z	v
04NM2	**German for Intermediate Students M2** *Ivana Pavlíková (Gar.)*	Z	1	0+2	L	v
04NM3	**German for Intermediate Students M2** *Miloslava Čechová (Gar.)*	Z	1	0+2	Z	v
04NP1	**German for Advanced Students P1** *Miloslava Čechová (Gar.)*	Z	1	0+2	Z	v
04NP2	**German for Advanced Students P2** *Miloslava Čechová (Gar.)*	Z	1	0+2	L	v
04NP3	**German for Advanced Students P3** *Miloslava Čechová (Gar.)*	Z	1	0+2	Z	v
01NME2	**Numerical Methods 2** *Michal Beneš Michal Beneš (Gar.)*	KZ	2	2+0	L	v
15CH1	**General Chemistry 1** *Alois Motl, Petr Distler, Václav Čuba **Petr Distler** Alois Motl (Gar.)*	Z	3	2+1	Z	v
15CH2	**General Chemistry 2** *Alois Motl, Petr Distler, Václav Čuba **Petr Distler** Alois Motl (Gar.)*	Z,ZK	3	2+1	L	v
02OR	**General Relativity** *Oldřich Semerák Oldřich Semerák (Gar.)*	ZK	3	3+0	L	v
01POPJ1	**Computers and Natural Language 1**	Z	2	0+2	Z	v
01POPJ2	**Computers and Natural Language 2**	Z	2	0+2	L	v
12POAL	**Computer Algebra** *Richard Liska Richard Liska (Gar.)*	KZ	2	2	Z	v
01POGR1	**Computer Graphics 1** *Pavel Strachota **Pavel Strachota** Pavel Strachota (Gar.)*	Z	2	2	Z	v
01POGR2	**Computer Graphics 2** *Pavel Strachota Tomáš Oberhuber (Gar.)*	Z	2	2	L	v
01SITE1	**Computer Networks 1** *Miroslav Mináriк Miroslav Mináriк (Gar.)*	Z	2	1+1	Z	v
01SITE2	**Computer Networks 2** *Miroslav Mináriк Miroslav Mináriк (Gar.)*	Z	2	1+1	L	v
01POPR	**Advanced Probability** ***Tomáš Hobza***	Z	2	2+0		v
12PEL1	**Practical Electronics 1**	Z,ZK	2	2+0	L	v
12PEL2	**Practical Electronics 2**	Z,ZK	2	2+0	Z	v
12PIN1	**Practical Informatics for Technics 1** *Richard Liska Richard Liska (Gar.)*	Z	2	1+1	L	v
12PIN2	**Practical Informatics for Technics 2** *Milan Šiňor Milan Šiňor (Gar.)*	Z	2	1+1	Z	v
12PIN3	**Practical Informatics for Technics 3** *Milan Šiňor Milan Šiňor (Gar.)*	Z	2	1+1	L	v
12EPR1	**Electronics Practicum 1** *Ivan Procházka, Jaroslav Pavel Ivan Procházka (Gar.)*	KZ	3	0+2	Z	v
12EPR2	**Electronics Practicum 2** *Ivan Procházka Ivan Procházka (Gar.)*	KZ	3	0+2	L	v
15INPR	**Laboratory Practice in Instrumental Methods**	KZ	4	0+4	L	v
01PRA1	**Probability and Mathematical Statistics 1**	Z,ZK	6	4+2	Z	v
01PRA2	**Probability and Mathematical Statistics 2**	ZK	2	2+0	L	v
01PRST	**Probability and Statistics** *Tomáš Hobza Tomáš Hobza (Gar.)*	Z,ZK	4	3+1	Z	v
01PRSTB	**Probability and Statistics B** *Tomáš Hobza Tomáš Hobza (Gar.)*	KZ	4	3+1	Z	v
16UAZB	**Principles of Ionizing-Radiation Applications** *Ladislav Musílek **Radek Fučík** Ladislav Musílek (Gar.)*	ZK	2	2+0	Z	v
16FNZB	**Problems of Non-ionizing Radiation** *Lenka Thinová **Radek Fučík** Lenka Thinová (Gar.)*	ZK	2	2+0	Z	v
12PSEM	**Problem Seminary**	Z	2	0+4	L	v
01PROP	**Programmer's Practicum** *Jakub Klinkovský Jakub Klinkovský (Gar.)*	Z	2	0+2	Z	v
01PERI	**Programming of Peripherals Devices** *Zdeněk Čulík (Gar.)*	Z	2	2+0	Z	v

01PW	**Windows Programming** *Zdeněk Čulík Zdeněk Čulík (Gar.)*	Z	2	2+0	Z	v
18PRC1	**Programming in C++ 1** *Vladimír Jarý, Miroslav Virius* ***Miroslav Virius*** *Miroslav Virius (Gar.)*	Z	4	2+2	Z	v
18PRC2	**Programming in C++ 2** *Vladimír Jarý, Miroslav Virius*	KZ	4	2+2	L	v
18PJ	**Programming in Java** *Miroslav Virius* ***Miroslav Virius***	Z,ZK	5	2+2	Z	v
18MTL	**Programming in MATLAB** ***Jaromír Kukal***	Z,ZK	5	2+2	Z	v
18MPT	**Programming in MATLAB** *Jaromír Kukal, Quang Van Tran* ***Quang Van Tran***	KZ	5	0+4	Z	v
18PAS	**Pascal Programming** ***Miroslav Virius***	Z	4	2+2	L	v
12PDR1	**Data Communication and Interfaces 1** *Josef Blažej Josef Blažej (Gar.)*	Z	2	2+0	Z	v
12PDR2	**Data Communication and Interfaces 2** *Josef Blažej Josef Blažej (Gar.)*	Z	2	2+0	L	v
01PSL	**LaTeX - Publication Instrument** *Petr Ambrož Petr Ambrož (Gar.)*	Z	2	0+2	L	v
00RET	**Rhetoric** *Jana Kovářová* ***Jana Kovářová***	Z	1	0+2		v
01RMF	**The Equations of Mathematical Physics** *Václav Klika* ***Václav Klika*** *Václav Klika (Gar.)*	Z,ZK	6	4+2	Z	v
02RQGP1	**Seminar on Quark-Gluon Plasma 1** ***Jaroslav Bielčík***	Z	1	2+0		v
02RQGP2	**Seminar on Quark-Gluon Plasma 2** ***Jaroslav Bielčík***	Z	1	2+0		v
04RM1	**Russian for Intermediate Students M1** *Zhanna Isaeva (Gar.)*	Z	1	0+2	Z	v
04RM2	**Russian for Intermediate Students M2** *Zhanna Isaeva (Gar.)*	Z	1	0+2	L	v
04RM3	**Russian for Intermediate Students M3** *Zhanna Isaeva (Gar.)*	Z	1	0+2	Z	v
04RP1	**Russian for Advanced Students P1** *Zhanna Isaeva (Gar.)*	Z	1	0+2	Z	v
04RP2	**Russian for Advanced Students P2** *Zhanna Isaeva (Gar.)*	Z	1	0+2	L	v
04RP3	**Russian for Advanced Students P3** *Zhanna Isaeva (Gar.)*	Z	1	0+2	Z	v
04RZ1	**Russian for Beginners Z1** *Zhanna Isaeva (Gar.)*	Z	1	0+4	L	v
04RZ2	**Russian for Beginners Z2** *Zhanna Isaeva (Gar.)*	Z	1	0+4	Z	v
04RZ3	**Russian for Beginners Z3** *Zhanna Isaeva (Gar.)*	Z	1	0+4	L	v
04RZ4	**Russian for Beginners Z4** *Zhanna Isaeva (Gar.)*	Z	1	0+4	Z	v
04RZ5	**Russian for Beginners Z5** *Zhanna Isaeva (Gar.)*	Z	1	0+4	L	v
01RSWP	**Project Management of Software Projects**	KZ	2	0+2	Z	v
02SMF	**Seminar of Mathematical Physics** *Ladislav Hlavatý (Gar.)*	Z	2	0+2	Z	v
01SSM1	**Seminar of Contemporary Mathematics 1** *Edita Pelantová (Gar.)*	Z	2	0+2	Z	v
01SSM2	**Seminar of Contemporary Mathematics 2** *Edita Pelantová, Václav Klika Edita Pelantová (Gar.)*	Z	2	0+2	L	v
16SED1	**Dosimetry Seminar 1** ***Kateřina Pilařová*** *Kamila Johnová (Gar.)*	Z	2	0+2		v
16SED2	**Dosimetry Seminar 2** ***Kateřina Pilařová*** *Kateřina Pilařová (Gar.)*	Z	2	0+2		v
01SMB1	**Seminar on Calculus B1** *Milan Krbálek Milan Krbálek (Gar.)*	Z	2	0+2	Z	v
01SMB2	**Seminar on Calculus B2** *Milan Krbálek Milan Krbálek (Gar.)*	Z	2	0+2	L	v
01SOS1	**Software Seminar 1** *Zdeněk Čulík* ***Zdeněk Čulík*** *Zdeněk Čulík (Gar.)*	Z	2	0+2	Z	v
01SOS2	**Software Seminar 2** *Zdeněk Čulík Zdeněk Čulík (Gar.)*	Z	2	0+2	L	v
02SPRA1	**Special Practicum 1** *Jan Čepila Jan Čepila (Gar.)*	KZ	6	0+4	Z	v
02SPRA2	**Special Practicum 2** *Jan Čepila Jan Čepila (Gar.)*	KZ	6	0+4	L	v
01STR	**Statistical Decision Theory** *Václav Kůs Václav Kůs (Gar.)*	ZK	2	2+0	L	v

11SFBM	**Structure and Function of Biomolecules** *Petr Kolenko **Petr Kolenko** Petr Kolenko (Gar.)*	Z,ZK	3	2+1	Z	v
04SM1	**Spanish for Intermediate Students M1** *Beatriz Vadillo Gonzalo (Gar.)*	Z	1	0+2	Z	v
04SM2	**Spanish for Intermediate Students M3** *Beatriz Vadillo Gonzalo (Gar.)*	Z	1	0+2	L	v
04SM3	**Spanish for Intermediate Students M3** *Beatriz Vadillo Gonzalo (Gar.)*	Z	1	0+2	Z	v
04SP1	**Spanish for Advanced Students P1** *Beatriz Vadillo Gonzalo (Gar.)*	Z	1	0+2	Z	v
04SP2	**Spanish for Advanced Students P2** *Beatriz Vadillo Gonzalo (Gar.)*	Z	1	0+2	L	v
04SP3	**Spanish for Advanced Students P3** *Beatriz Vadillo Gonzalo (Gar.)*	Z	1	0+2	Z	v
04SZ1	**Spanish for Beginners Z1** *Beatriz Vadillo Gonzalo (Gar.)*	Z	1	0+4	L	v
04SZ2	**Spanish for Beginners Students Z2** *Beatriz Vadillo Gonzalo (Gar.)*	Z	1	0+4	Z	v
04SZ3	**Spanish for Beginners Z3** *Beatriz Vadillo Gonzalo (Gar.)*	Z	1	0+4	L	v
04SZ4	**Spanish for Beginners Z3** *Beatriz Vadillo Gonzalo (Gar.)*	Z	1	0+4	Z	v
04SZ5	**Spanish for Beginners Z5** *Beatriz Vadillo Gonzalo (Gar.)*	Z	1	0+4	L	v
14TM	**Engineering Mechanics** *Jiří Kunz, Jan Ondráček Jiří Kunz (Gar.)*	Z,ZK	4	2+2	3	v
14TEM	**Engineering Mechanics** *Jiří Kunz, Jan Ondráček Jiří Kunz (Gar.)*	Z,ZK	6	4	5	v
12TAIS	**Ion Beam Techniques and Applications.** *Michaela Martínková, Jaroslav Král Jaroslav Král (Gar.)*	ZK	3	3+0	L	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
02TEF1	**Theoretical Physics 1** *Petr Novotný Igor Jex (Gar.)*	Z,ZK	4	2+2	Z	v
02TEF2	**Theoretical Physics 2** *Igor Jex, Petr Novotný **Jan Vysoký** Igor Jex (Gar.)*	Z,ZK	4	2+2	L	v
01DYSY	**Theory of Dynamic Systems** *Branislav Rehák Branislav Rehák (Gar.)*	ZK	3	3+0	L	v
01TKO	**Theory of Codes** *Edita Pelantová, Jan Volec Jan Volec (Gar.)*	ZK	2	2	L	v
02TER	**Heat and Molecular Physics** *Petr Jizba Petr Jizba (Gar.)*	Z,ZK	4	2+2	L	v
02TSFA	**Thermodynamics and Statistical Physics** *Igor Jex, Jaroslav Novotný Igor Jex (Gar.)*	Z,ZK	4	2+2	L	v
01TOP	**Topology** *Čestmír Burdík Čestmír Burdík (Gar.)*	ZK	2	2+0	Z	v
16MCRB	**Transport of Ionizing Radiation and Monte Carlo Method** *Tomáš Urban, Jaroslav Klusoň **Tomáš Urban** Tomáš Urban (Gar.)*	Z,ZK	4	2+2	L	v
18INTA	**Generation of Internet Applications** *Dana Majerová*	KZ	4	2+2	L	v
01DYK	**Introduction to Continuum Dynamics** *Pavel Strachota **Pavel Strachota** Pavel Strachota (Gar.)*	Z	2	0+2		v
16ZIVB	**Introduction to Ecology** *Lenka Thinová, Hana Průšová **Radek Fučík** Lenka Thinová (Gar.)*	KZ	2	2+0	Z	v
02UFEC	**Introduction to Elementary Particle Physics** *Jaroslav Bielčík **Jaroslav Bielčík** Jaroslav Bielčík (Gar.)*	Z	2	2+0	Z	v
11UFPLN	**Introduction to Solid State Physics** *Petr Kolenko, Ivo Kraus **Petr Kolenko** Ivo Kraus (Gar.)*	ZK	2	2+0	L	v
17UINZ	**Introduction to Engineering** *Tomáš Bílý, Jan Frýbort, Petr Haušild, Radek Mušálek*	Z,ZK	3	2+1	Z	v
02UKP	**Introduction to Curves and Surfaces**	Z	2	1+1	L	v
12ULT	**Introduction to Laser Technique** *Jan Šulc, Helena Jelínková Jan Šulc (Gar.)*	Z,ZK	3	2+1	Z	v
12UMF	**Introduction to Modern Physics** *Jan Pšikal Jan Pšikal (Gar.)*	Z	3	2+1	L	v
18UOA	**Introduction into Object Oriented Architecture** *Rudolf Pecinovský **Rudolf Pecinovský***	Z,ZK	4	2+2	Z	v
00UPRA	**Introduction to Law** *Jana Kovářová, Miloslava Čechová, Martin Čech **Jana Kovářová***	Z	1	0+2		v
00UPSY	**Introduction to Psychology** *Jana Kovářová, Miloslava Čechová, Jakub Hajíček **Jana Kovářová***	Z	1	0+2		v

01UTIZ	**Introduction to Theoretical Informatics** ***Petr Ambrož***	ZK	2	2+0		v
11UVOD	**Introduction to Specialization**	Z	2	0+2	Z	v
12VAK	**Vacuum Physics and Technology** *Jaroslav Král, Richard Švejkar Jaroslav Král (Gar.)*	KZ	4	2+2	Z	v
12PYTH	**Scientific Programming in Python** *Pavel Váchal, Jakub Urban* ***Pavel Váchal*** *Pavel Váchal (Gar.)*	Z	2	0+2	Z	v
12VTV	**Scientific and Technical Computing** *Ivan Procházka Ivan Procházka (Gar.)*	Z	2	1+1	L	v
12VFT	**High Frequency and Impulse Circuitry** *Jaroslav Pavel Jaroslav Pavel (Gar.)*	Z,ZK	2	2+0	L	v
17VYR	**Research Reactors**	ZK	2	2	L	v
12ZPLT	**Basic Laser Technique Laboratory** *Josef Blažej, Václav Kubeček Václav Kubeček (Gar.)*	KZ	6	0+4	L	v
12ZPOP	**Basic Optical Laboratory** *Alexandr Jančárek Alexandr Jančárek (Gar.)*	KZ	6	0+4	L	v
18ZALG	**Basics of Algorithmization** *Zdeněk Čulík, Miroslav Virius, Tomáš Oberhuber*	Z,ZK	4	2+2	L	v
16AMMB	**Fundamentals of Analytical Measurement Methods** *Hana Průšová* ***Radek Fučík*** *Hana Průšová (Gar.)*	ZK	2	2+0	L	v
16ZBAF1	**Fundamentals of Human Biology, Anatomy and Physiology 1** *Alena Doubková, Šimon Vaculín, Zdeňka Polívková, Josef Stingl Alena Doubková (Gar.)*	Z,ZK	4	2+2	Z	v
16ZBAF2	**Fundamentals of Human Biology, Anatomy and Physiology 2** *Alena Doubková, Šimon Vaculín, Josef Stingl Alena Doubková (Gar.)*	Z,ZK	4	2+2	L	v
16ZDOZ1	**Fundamentals of Radiation Dosimetry 1** *Tomáš Trojek Tomáš Trojek (Gar.)*	Z,ZK	4	2+2		v
16ZDOZ2	**Fundamentals of Radiation Dosimetry 2** *Tomáš Trojek Tomáš Trojek (Gar.)*	ZK	2	2+0	L	v
17ZEH	**Basics of Economic Assessment** *Radovan Starý* ***Radovan Starý*** *Radovan Starý (Gar.)*	ZK	2	2+0	Z	v
17ZEL	**Basics of Electronics** *Martin Kropík Martin Kropík (Gar.)*	KZ	3	2+2	Z	v
12ZEL1	**Basic Electronics 1** *Jaroslav Pavel Jaroslav Pavel (Gar.)*	Z,ZK	3	2+1	Z	v
12ZEL2	**Basic Electronics 2** *Jaroslav Pavel Jaroslav Pavel (Gar.)*	Z,ZK	3	2+1	L	v
02ZFM1	**Foundations of Physical Measurements 1** *Petr Chaloupka Petr Chaloupka (Gar.)*	Z	2	2+0	Z	v
02ZFM2	**Foundations of Physical Measurements 2**	Z	2	0+2	L	v
11ZFPL	**Basic to Solid State Physics** *Ivo Kraus, Jaroslava Jakoubková, František Hájek* ***Jaroslava Jakoubková*** *Ivo Kraus (Gar.)*	KZ	2	2	Z	v
12ZFP	**Principles of Plasma Physics** *Jiří Limpouch Jiří Limpouch (Gar.)*	Z,ZK	4	3+1	L	v
02ZJF	**Nuclear Physics** *Vladimír Wagner Vladimír Wagner (Gar.)*	Z,ZK	6	3+2	Z	v
02ZJFB	**Nuclear Physics B** *Vladimír Wagner Vladimír Wagner (Gar.)*	KZ	3	3+0	Z	v
15ZKJE	**Nuclear Power Plants Design and Operation** *Tomáš Bílý, Lenka Frýbortová, Ľubomír Sklenka Tomáš Bílý (Gar.)*	ZK	3	2+0	L	v
16MEZB	**Fundamentals of Ionizing-Radiation Metrology** *Pavel Novotný* ***Radek Fučík*** *Tomáš Čechák (Gar.)*	Z,ZK	4	2+1	Z	v
01ZOS	**Introduction to Operating Systems** *Zdeněk Čulík Zdeněk Čulík (Gar.)*	Z	2	2+0	L	v
12ZAOP	**Fundamentals of Optics** *Ivan Richter, Pavel Kwiecien Ivan Richter (Gar.)*	Z,ZK	2	2+0	Z	v
01ZPB1	**Introduction to Computer Security 1** *Petr Vokáč* ***Petr Vokáč*** *Petr Vokáč (Gar.)*	Z	2	1+1		v
16ZPSP	**Basic Work with PC** ***Tereza Hanušová*** *Tomáš Vrba (Gar.)*	Z	2	0+2	1	v
18ZPRO	**Basics of Programming** *Vladimír Jarý, Zdeněk Čulík, Miroslav Virius, Lucie Roškotová, Aleš Suchomel, František Voldřich, Jan Thiele* ***Miroslav Virius***	Z	4	2P+2C	Z	v
16ZRAO	**Basics of Radiation Protection** *Tomáš Vrba* ***Tomáš Vrba*** *Tomáš Vrba (Gar.)*	Z	2	2+0		v
02ZSM	**Introduction to the Standard Model** *Zdeněk Hubáček* ***Jan Čepila*** *Zdeněk Hubáček (Gar.)*	ZK	2	2+0		v
16ZEDB	**Basics of Experimantal Data Processing** *Kateřina Pilařová* ***Kateřina Pilařová*** *Kateřina Pilařová (Gar.)*	ZK	2	2+0	Z	v
14ZZKS	**Testing and Processing of Metals and Alloys** *Hynek Lauschmann Hynek Lauschmann (Gar.)*	KZ	4	4	6	v

12ZDP	**Data Processing for Publishing** *Antonín Novotný Antonín Novotný (Gar.)*	Z	2	2	Z	v
12ZMD	**Measurement and Data Processing** *Ivan Procházka Ivan Procházka (Gar.)*	KZ	2	1+1	Z	v

Characteristics of the courses of this group of Study Plan: Code=BSVOLPREDM Name=BS - volitelné předměty

12EPR1	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	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.			
12ULT	Introduction to Laser Technique	Z,ZK	3
Overview of electromagnetic radiation sources; laser principle; classification of lasers; characterization and rough application of various types of lasers; laser safety precautions.			
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.			
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.			
16ZPSP	Basic Work with PC	Z	2
The aim of the subject is to teach basic skills associated with a personal computer. The introductory part of the course is devoted to information systems and resources available to the CTU and PNSPE students. Another part summarizes basic information about computer hardware, software and security. Most of the course is devoted to exercises whose aim is to teach students to use office software (word processor, spreadsheet, presentation software) at a level that is required in other courses of study (practice, undergraduate thesis, research and thesis).			
18ZPRO	Basics of Programming	Z	4
This lecture 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 C++programming language.			
02PRA1	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.			
02PRA2	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.			
12LT1	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.			
12LT2	Laser Technique 2	Z,ZK	2
Laser oscillator, the rate equation, the laser amplifier, Q-switching, mode-locking			
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.			
12ZPLT	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.			
12ZAOP	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.			
12ZMD	Measurement and Data Processing	KZ	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.			
12AUX	Administration of UNIX System	KZ	2
Basic and more advanced administration of Unix operating system			
12APL	Application of Lasers	Z,ZK	2
Application of lasers in industrial technologies, medicine, remote sensing, energetics, telecommunication, military, entertainment and other branches.			

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.			
12ZPOP	Basic Optical Laboratory	KZ	6
The practical laboratories give advanced practical skills by experimental work in optics and optoelectronics. Laboratory records must be elaborated.			
01ALG	Algebra	ZK	4
After an introduction into the set theory standard algebraic structures are dealt with: groups, rings, fields, modules, linear algebras, lattices, Boolean algebras, rings of polynomials over commutative fields.			
01ALGE	Algebra	Z,ZK	6
Firstly, the Peano axioms are treated in detail. Elements of the set theory cover only: equivalence and subvalence, the Cantorov-Bernstein theorem, the axiom of choice and equivalent statements, definition of ordinals and cardinals. Further standard algebraic structures are addressed: semigroups, monoids, groups, rings, integral domains, principal ideal domains, fields, lattices. Independent chapters are devoted to divisibility in integral domains and to finite fields.			
11ANEL	Linear Circuit Analysis	Z,ZK	4
The course is the introduction to the linear electronics for physicists. In the first part it describes basic methods of linear circuit analysis. It is especially oriented to the understanding of the computer methods of analysis. The second part gives a short list of most commonly used circuits in experimental equipment.			
15CHEM	Analytical Calculations and Chemometry Principals	ZK	2
Lecture deals with basic principles of chemometry including errors in classical and instrumental analysis, probability theory, propagation of errors, basic data distributions, one- and two-tailed significance testing, hypothesis testing, least squares regression and correlation, calibration and fitting methods, non-parametric testing, seminar part consists of equation solving, titration stoichiometry of redox, acid-base, complex and precipitation reactions, gravimetric stoichiometry. pH calculations, calculations in potentiometry, coulometry, spectrophotometry and separation methods, solving of complex forming equilibria.			
04ABZK	English - State Examination	ZK	5
The course content is the examination as given by the study plan. Student is eligible for the State language examination (level C1 or B2 of CEFR) only if he/she has passed all the respective courses and examinations (04AP3KK, 04APAK, 04API, and 04APRK). From its first semester, part of the APIN programme covers also examination subjects. As required, examination conditions comply with respective rules and regulations for state language examinations.			
04AM1	English for Intermediate Students M1	Z	1
The course is designed for students who have successfully completed the full secondary school English language course at least at the A2 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.			
04AM2	English for Intermediate Students M2	Z	1
The 04AM2 course expects the student to have completed the 04AM1 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.			
04AM3	English for Intermediate Students M3	Z	1
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.			
04AP1	English for Advanced Students P1	Z	1
The course is designed for students who have successfully completed the full secondary school English language course (at least 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), i.e., into the fundamentals of vocabulary, functions, grammar, and style typical of professional oral and written communication situations (fundamentals of terms in mathematics and physics, definitions, graph descriptions, etc). It also covers professional oral and written communication on topics related to the undergraduate´s life and needs. It develops skills for free professional writing (writing a CV, letter of application, polite request). If necessary, revision of selected grammar topics is included.			
04AP2	English for Advanced Students P2	Z	1
The 04AP2 course is based on 04AP1, thus extending the student´s skills for working with subtechnical texts, and even with professional texts of chosen branches of science. According to the students´ needs it concentrates on chosen grammar topics, but mainly intends to develop understanding of syntactic structures and typical rhetorical functions (e.g., various types of descriptions, and, if possible, a case study). Increasing emphasis is placed on the undergraduate´s independent work with and reading of linguistically more demanding materials. The course extends the student´s subtechnical vocabulary, and includes fundamental notions of chosen branches of science. It is focused on formal writing including the sentence and paragraph structure, linking, cohesion and coherence in texts.			
04AP3	English for Advanced Students P3	Z	1
The 04AP3 course is based on 04AP2 and expects the student to work without any guidance with authentic professional materials and to interpret the text. It includes training oral and written communication skills and functions (e.g., expressing an opinion, agreement, and objections; taking part in discussion, note-taking; summarizing, writing an abstract) and, if possible, also preparing a project on a given or chosen topic and presenting it. The course places emphasis on distinguishing levels of formal and informal language both in oral and written communication.			
16APLB	Application of Ionizing Radiation in Analytical Methods	ZK	5
Subject The application of ionizing radiation in analytical methods is devoted to radioanalytical methods and the use of radionuclides and ionizing radiation in the analysis and diagnosis of technological processes.			
11APLG	Applications of Group Theory in Solid State Physics	ZK	2
Consideration of atomic system symmetry allows, without any quantitative calculations, rigorously and precisely determine how many energy states there are and what interactions and transitions between them may occur. Therefore, the main purpose of this course is to describe the methods by which we can extract the information on the object that symmetry alone will provide. The application of these methods is illustrated by an example of molecular orbitals, inner orbitals of ions in the crystal field environment, normal modes of molecular vibrations, and selection rules for optical absorption transitions.			
02AMS	Atomic and Molecular Spectroscopy	Z,ZK	4
The lecture is devoted to atomic and molecular spectroscopy.			
04CESM1	Czech for foreigners - Intermediate	Z	1
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.			
04CESM2	Intermediate Czech 2	Z	1
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.			

04CESM3	Intermediate Czech 3	Z	1
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.			
04CESP1	Czech for Foreign Students - Advanced Examination	Z	1
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.			
04CESP2	Czech for Foreigners - Advanced	Z	1
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.			
04CESP3	Czech for Foreigners - Advanced	Z	1
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.			
15DALCH	History of Alchemy and Chemistry	ZK	2
This course provides the overview of crafts with chemical and/or metallurgical basis. Development of alchemy from ancient times in China, India, and Hellenistic world is discussed. The last part of course is dedicated to Alchemy in Arabic world and various aspects of alchemy in Latin Europe. The influence of alchemical approaches development onto crafts advancement is illustrated.			
02DEF1		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.			
02DEF2	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.			
01DEM	History of Mathematics	Z	1
The subject has the form of regular seminars where the members of the department of mathematics, but also invited speakers - specialists in the field - give their talks on varoius topics from the history of mathematics.			
02DRG	Differential Equations, Symmetries and Groups	Z	4
The purpose of the lecture is to teach students computation of symmetries of the differential equations.			
01DIM1	Discrete Mathematics 1	Z	2
The seminar is devoted to elementary number theory and applications. It includes individual problem solving.			
01DIM2	Discrete Mathematics 2	Z	2
The seminar is devoted to recurrence relations. It includes individual problem solving.			
01DIM3	Discrete Mathematics 3	Z	2
The subject is devoted to elementary proofs of non-trivial combinatoriwal identities and to generating functions and their applications. In the seminar students present a problem with solution chosen from the given literature.			
00EKOT	Economy in Technology	Z	1
The course introduces the basics of micro- and macroeconomics.			
11ELEA	Instrumentation and Measurement	Z,ZK	2
The course is the introduction to the instrumentation and measurement for physicists.			
14ELMI	Electron Microscopy	Z,ZK	3
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.			
12EGS1	English Graduate Standard 1	KZ	4
Improving the knowledge in English, English Presentation, English Discussions, creation of the technical text, structures of important documents, Proceedings to be published			
18ESPG1	European Computer Driving Licence 1	Z	2
Spreadsheet calculators are an important tool, especially for students and graduates in Software engineering in economics. The winter semester introduces the students also into other office tools. The accent is put on advanced functions of MS Excel (names, functions and expressions, pivot table and graph). Next, the VBA language will be introduced and macros and user functions will be addressed.			
18ESPG2	European Computer Driving Licence 2	Z	2
Spreadsheet calculators are an important tool, especially for students and graduates in Software engineering in economics. Summer semester follows the winter semester with advanced VBA programming topics (charts, objects, graphical user interface, add-ins programming) and introduces some applications in economics, mathematics, operational research, and computer science.			
16EPAM	Exact Methods in Research of Historic Monuments	ZK	2
Aims and methods of historic monument investigations, methods of age determination (radiocarbon, thermoluminescence and related methods, further radiation methods, dendrochronology, archaeomagnetism), analytical methods for determination of origin and production technologies of artefacts (activation analysis, X-ray fluorescence analysis and other methods), photogrammetry.			
02EXF1	Experimental Physics 1	Z	2
Lecture represents an introductory course in experimental physics. Students will learn methods of measurement of basic physical quantities and methods of measurement evaluation.			
02EXF2	Experimental Physics 2	ZK	2
Lecture represents an introductory course in experimental physics. Students will learn methods of measurement of basic physical quantities and methods of measurement evaluation.			
17ENF	Experimental Neutron Physics	KZ	2
The lectures are mainly focused on detailed characterisation of neutron properties, characteristics of neutron (reactor and non reactor) sources, properties of prompt and delayed neutrons, neutron detection methods, neutron induced nuclear reactions, modification and adjustment of neutron field, science and industry neutron applications. Last lecture deals with experimental data processing and analysis. The lectures are supplemented with experimental practices in the field of neutron detection, determination of delayed neutron properties, study of neutron diffusion in various materials, preparation and characterisation of photo-neutron source and neutron source calibration. Experimental practices will be running at training reactor VR-1 and in the neutron laboratory.			

04FM1	French for Intermediate Students M1	Z	1
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. 04FM1 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.			
04FM2	French for Intermediate Students M2	Z	1
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.			
04FM3	French for Intermediate Students M3	Z	1
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.			
04FP1	French for Advanced Students P1	Z	1
04FP 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. 04FP1 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.			
04FP2	French for Advanced Students P2	Z	1
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).			
04FP3	French for Advanded Students P3	Z	1
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.			
04FZ1	French for Beginners Z1	Z	1
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. 04FZ1 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.			
04FZ2	French for Beginners Z2	Z	1
The course is linking up with 04FZ1. 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.			
04FZ3	French for Beginners Z3	Z	1
The course builts upon 04FZ2. 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.			
04FZ4	French for Beginners Z4	Z	1
The course builds up on 04FZ3. 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.			
04FZ5	French for Beginners Z5	Z	1
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.			
01FKP	Functions of Complex Variable	ZK	2
The course develops advanced properties of systems of holomorphic functions, Ascoli-Vitali's theorem, advanced properties of conformal mappings, transcendental and meromorphic functions. Basic properties of complex functions of several complex variables together with improper line integrals and its applications are presented.			
01FKPB	Functions of Complex Variable B	Z	2
The course develops advanced properties of systems of holomorphic functions, Ascoli-Vitali's theorem, advanced properties of conformal mappings, transcendental and meromorphic functions. Basic properties of complex functions of several complex variables together with improper line integrals and its applications are presented.			
01FAN1	Functional Analysis 1	Z,ZK	4
Basic notions and results are addressed concerning successively topological spaces, metric spaces, topological vector spaces, normed and Banach spaces, Hilbert spaces.			
01FA1	Functional Analysis 1	Z,ZK	3
Continuing course of mathematical analysis and algebra introduction to the basics of functional analysis. There are the concepts that students need to understand the various physical and technical disciplines.			
01FA2	Functional Analysis 2	Z,ZK	4
The course aims to present selected fundamental results from functional analysis including basic theorems of the theory of Banach spaces, closed operators and their spectrum, Hilbert-Schmidt operators, spectral decomposition of bounded self-adjoint operators.			
02FYS1	Physical Seminar 1	Z	2
The seminar is devoted to detailed study of interesting physical problems. It should help students to deeper understanding of fundamentals of physics presented in the course of Mechanics. The problems are chosen, studied and presented by the students themselves, with the possibility to use PC and physical laboratory equipments.			

02FYS2	Physical Seminar 2	Z	2
The seminar is devoted to detailed study of interesting physical problems. It should help students to deeper understanding of fundamentals of physics presented in the course of Electricity and Magnetism. The problems are chosen studied and presented by the students themselves, with the possibility to use PC and physical laboratory equipments.			
01GTDR	Geometric Theory of Ordinary Differential Equations	Z	2
The seminar consists of the qualitative theory of ODEs dealing with the geometric and topological properties of the solution. In this context, we mention suitably formulated basic results of the existence and uniqueness, continuous dependence on parameters and initial conditions. Main part is devoted to the autonomous systems.			
12INS1	Information Systems 1	Z,ZK	2
Information technology, architecture of the databases, network databases, cloud application Google, Microsoft, information managament, aproaches to solve task of information systems			
12INS2	Information Systems 2	Z,ZK	2
Graduation of Information systems 1 is required. In more details: Information technology, architecture of the databases, network databases, cloud application Google, Microsoft, information managament, aproaches to solve task of information systems			
16ZJTB	Nuclear Energy Facilities and Accelerators	ZK	2
Basic scheme of nuclear reactor and nuclear power plant, chain fission reaction development, main components of nuclear energetic reactor, most important reactor types, linear high-voltage accelerators, linear high-frequency accelerators, accelerators based on cyclotron, microtron, betatron, electron and proton synchrotrons, electron and ion sources for accelerators, targets.			
17JARE	Nuclear Reactors	ZK	2
Introduction. World power issue. Previous evolution of power reactor. Nuclear fission reactors, fuel assemblies, active core, control systems, safety systems, containment. Classification of reactors into IV generations. Standard types of nuclear power reactors: concept, description, layout, previous evolution, world share, perspectives. Pressurized water reactors (PWR). Western-type PWR (Westinghouse, KWU, Framatom). VVER-type reactors , Temelín nuclear power plant. Boiling water reactors. Heavy water reactors, fast breeder reactors, high-temperature gas cooled reactors. Second nuclear era. reactors of generation III (EPR, AP-1000, VVER 1200). Reactors of generation IV: GIF and INPRO initiatives. Evaluation and selection of proposed systems. Six selected concepts. ICRP scenarios of word evolution, hydrogen power, role of nuclear power in long-term outlook			
01JEPR	Simple Compilers	Z	2
Lexical and syntax analysis, code generation, simple optimizations, development environments, reflection.			
16KPR	Clinical Propaedeutic	ZK	2
Making students familiar with the basics of anamnesis, physical examination, examinational methods of different organs, hematological and biochemical examinations and anaesthesia			
04AKS	English Conversation	Z	1
The course will develop the student´s communication skills acquired throughout their previous studies. It aims to improve all aspects of oral communication. The student will develop their vocabulary for various communication situations and will master their communication strategy. They will also practise their listening skills in order to better follow and participate in discussions. The student will be trained to express their ideas clearly and according to current English usage, and become a more confident speaker.			
02KF	Quantum Physics	Z,ZK	3
State description, wave function, postulates of quantum mechanics, Born s statistical interpretation, expectation values, Schrödinger equation, Heisenberg uncertainty principle, quantization of angular momentum, solution of simple systems, hydrogen atom.			
02LCF1	Experimental Laboratory 1	Z	2
Cavendish experiment. Elasticity.Thermal capacities. Electric measurements, Acoustic. Oscillations.			
02LCF2	Experimental Laboratory 2	Z	2
Electric and magnetic field, microwaves, Xray and gamma rays, geometric optics			
01LIP	Linear Programming	Z,ZK	3
We study special problems about constrained extremum problems for multivariable functions (the function is linear and the constraint equations are given by linear equations and linear inequalities).			
18MAK1	Macroeconomics 1	Z,ZK	4
Macroeconomics I provides students with a fundamental theoretical basis for understanding how an economy works. It introduces main macroeconomic indicators, money market, macroeconomic equilibrium theory, fundamentals of open economy theory, inflation, unemployment, economic growth, economic fluctuations, basic macroeconomic models of IS-LM, AS-AD and their implications for economic policies. The learning outcomes of the course is to equip students with ability to analyze macroeconomic phenomena and their interconnections and subsequently to use them under the conditions of modern economic life.			
18MAK2	Macroeconomics 2	Z,ZK	4
Macroeconomics II extends theoretical knowledge acquired from Macroeconomics I of its students with the latest knowledge of contemporary macroeconomics. They are models of economic growth, especially those with an emphasis on the role of human capital and technological progress. Furthermore, it introduces students to modern principles of economic modeling, i.e., macroeconomic models derived from microeconomic behavior of subjects and economics and their rational expectations. It also provides students with modern knowledge of labor market modeling.			
01MAPR	Markov processes	Z,ZK	4
18EKO1	Mathematical Economics 1	Z,ZK	5
The course introduces selected models and methods for economic decision making. The main attention is given to optimization models of linear programming, possibilities of their real applications and their solving by means of the current software products.			
18EKO2	Mathematical Economics 2	Z,ZK	5
The course introduces selected models and methods for economic decision making. The main attention is given to optimization models in graphs, project management, inventory management with deterministic and stochastic demand, queuing theory and simulation models.			
01MASC	Mathematical Statistics - Seminar	Z	2
The subject is devoted to practical use of statistical methods studied in the course Mathematical Statistics 01MAS. The tutorial deals with calculation of Fisher information matrix of statistical models, finding unbiased estimators with minimal variance, parameter estimation by method of moments and method of maximum likelihood, derivation of critical regions for hypothesis testing using the Neyman-Pearson lemma and likelihood ratio, calculation of confidence intervals and non-parametric density estimation.			
00MAM1	Essentials of High School Course 1	Z	1
00MAM2	Essentials of High School Math Course 2	Z	1
Review of basics of high school mathematics.			
01MMPV	Mathematical Models of Groundwater Flow	KZ	2
The course provides an overview of computational methods for selected groundwater flow problems. The first part of the course is devoted to mathematical formulations of these problems. The second part is aimed at selected numerical methods, emphasizing implementation issues related to these methods.			
01MMF	Methods of Mathematical Physics	Z,ZK	6
The course provides an introduction to the theory of distributions with applications to solutions of partial differential equations with constant coefficients, further the Fredholm theorems are discussed for the case of a continuous kernel on a compact set as well as Sturm-Liouville operators on bounded intervals, and applications of the separation of variables method to the solution of some boundary value problems and mixed problems.			

18MIK1	Microeconomics 1	Z,ZK	5
Microeconomics is a set of theories, which help us to understand processes by which the scarce resources are allocated among alternative uses. Microeconomics explains the role of prices and markets in these processes, and makes more clear behaviour of the economic agents. This course of Microeconomics I consist of introduction in Microeconomics and Consumer Theory.			
18MIK2	Microeconomics 2	Z,ZK	5
Microeconomics is a set of theories, helping us to understand process by which scarce resources are allocated among alternative uses. Microeconomics explain the role of prices and markets in this process and make clear economic agents behaviour. The lectures of Microeconomics II are oriented on Theory of Firm and Industrial Organisation.			
11MIK	Logical Circuits and Microprocessors	Z,ZK	4
The course is the introduction to the digital electronics for physicists. It describes the function principles of combination circuits, simple sequential circuits and complex circuits like microprocessors. The microcomputer architecture and principles of interfacing is shown.			
12MOF	Molecular Physics	ZK	2
Basic ideas on multi-atomic molecules and molecular matter, and on structure-to-physical properties relations. 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.			
02NSAD	Simulations and Data Analysis Tools	Z	2
Data analysis and simulations of high energy elementary particle collisions. ROOT and Pythia programs.			
04NM1	German for Intermediate Students M1	Z	1
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.			
04NM2	German for Intermediate Students M2	Z	1
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).			
04NM3	German for Intermediate Students M2	Z	1
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).			
04NP1	German for Advanced Students P1	Z	1
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.			
04NP2	German for Advanced Students P2	Z	1
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).			
04NP3	German for Advanced Students P3	Z	1
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.			
01NME2	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.			
15CH1	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 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.			
02OR	General Relativity	ZK	3
Introduction to general theory of relativity: principle of equivalence and principle of general covariance, parallel transport and geodesic equation, gravitational redshift. Curvature and Einstein's gravitational law. Schwarzschild solution of the Einstein equations, homogeneous and isotropic cosmological models.			
01POPJ1	Computers and Natural Language 1	Z	2
Basic course of computational processing and understanding of natural languages. Automatic methods of morphological and syntactic analysis including modern statistical methods of result disambiguation will be discussed. Two-level morphology, tagging and language models, Viterbi algorithm, grammars, chart parsing, probabilistic grammars.			
01POPJ2	Computers and Natural Language 2	Z	2
The goal of the course is to get acquainted with the broad topic of machine translation (MT). Machine translation is a challenging task that can serve as a good example for modeling of systems as complex as natural languages. We cover several rather different approaches to the task as well as issues related to automatic and manual evaluation of translation quality.			

12POAL	Computer Algebra	KZ	2
Lisp, representation of basic objects (integers, rational and algebraic numbers, polynomials, rational functions, radicals, algebraic functions), arithmetics, simplification, greatest common divisor, resultant, derivation, series summation, integration, ordinary differential equations, factorization, equations solving, quantifier elimination, substitution and pattern matching, algebraic programming, graphics, Maple - detailed introduction and solving of practical examples, applications, overview of other systems (Axiom, Macsyma, Mathematica), miniproject.			
01POGR1	Computer Graphics 1	Z	2
The first part of the two-semester "Computer Graphics" course is devoted to the specifics of digital display devices spanning from history up to the state of the art technologies. Further, a survey of fundamental problems in 2D computer graphics is given together with their solutions. Focus is put on mathematical description of problems and explanation of the corresponding algorithms using knowledge previously obtained in a variety of subjects available at FNSPE. The final part of the course covers the applications of computer graphics approaches in the process of authoring scientific documents and presentations.			
01POGR2	Computer Graphics 2	Z	2
The second part of the two-semester "Computer Graphics" course begins with a brief introduction to signal theory in the context of aliasing - a phenomenon ubiquitous in computer graphics. Further, a well structured survey of fundamental problems in 3D computer graphics is given together with their solutions, from the description of a 3D scene to its realistic rendering. Focus is put on mathematical description of problems and explanation of the corresponding algorithms using knowledge previously obtained in a variety of subjects available at FNSPE. The algorithm implementation aspect such as data structures design etc. is also a matter of concern. In the last lecture, a number of theoretical concepts are demonstrated using Blender, an open-source 3D modeling and rendering software instrument.			
01SITE1	Computer Networks 1	Z	2
Understanding the history and present network (LAN, WAN, use the principles and technologies). Architecture of reference model ISO/OSI. Network protocols, practical exercises with TCP/IP communications. Internet services - mail, remote access, www. Secure communication, tunneling. Directory services, certificates, certification authorities, public key infrastructure (PKI). Use in practice. Network security - firewalls (packet filters, proxies, gateways, NAT, DMZ), practical exercises. (According to the interest - the serial control lines, modems)			
01SITE2	Computer Networks 2	Z	2
Understanding the history and present network (LAN, WAN, use the principles and technologies). Architecture of reference model ISO/OSI. Network protocols, practical exercises with TCP/IP communications. Internet services - mail, remote access, www. Secure communication, tunneling. Directory services, certificates, certification authorities, public key infrastructure (PKI). Use in practice. Network security - firewalls (packet filters, proxies, gateways, NAT, DMZ), practical exercises. (According to the interest - the serial control lines, modems)			
01POPR	Advanced Probability	Z	2
The subject is devoted to advanced Theory of probability and statistics on measure-theoretic level for general distributions of random variables. We deal with sample and integral characteristics of random variables and convergence criteria. Further, the theory of statistical model estimation and testing is extended for parametric and nonparametric cases.			
12PEL1	Practical Electronics 1	Z,ZK	2
Recapitulation of basics electronic, mathematical analyses of circuit solving. Measurement in electronic, measurement of frequency and phase. Analogue to digital converters and digital signal processing. Function of voltmeter, ampermeter, oscilloscope, spectral analyser and logical analyser.			
12PEL2	Practical Electronics 2	Z,ZK	2
Noise analyses in electronics, low noise electronics system design. Noise measurement. Time measurement. Printed circuit design.			
12PIN1	Practical Informatics for Technics 1	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. Requirements on operating system for research and technical computing. Operating system UNIX. Basic principles, kernel, kernel services. Documentation. File system, file atributes, working with files. Text editors: vi, emacs. Command interpreter (shell) sh, csh and its programming (scripts). Controlling processes, process status, computer load a process priorities. Standard tools. Graphical user interface X-windows. Computer networks. Local computer networks. Global computer networks: Internet. Addresses and protocols TCP/IP. Network configutation of a computer. Network services: hardware sharing, mail, ftp, etc. Network applications			
12PIN2	Practical Informatics for Technics 2	Z	2
Practically oriented three semester course of basics and applications of informatics for science and engineering included as obligatory alternative course. Constituent part is realized in computer classrooms. The second part of the course is "Introduction to computer algebra systems?.			
12PIN3	Practical Informatics for Technics 3	Z	2
Practically oriented three semester course of basics and applications of informatics for science and engineering included as obligatory alternative course. Constituent part is realized in computer classrooms. The third part of the course is "Introduction to scientific computing?.			
15INPR	Laboratory Practice in Instrumental Methods	KZ	4
Practical training of students in the use of selected modern instrumental methods and techniques for solving some physico-chemical analytical and others problems. The training is carried out in the laboratories of Czech Academy of Sciences (Institute of Physical Chemistry) and partly in laboratory at the Department of Nuclear Chemistry.			
01PRA1	Probability and Mathematical Statistics 1	Z,ZK	6
The subject is devoted to the introduction to Theory of probability and statistics on measure-theoretic level for discrete models, continuous distributions and general distributions of random variables. We deal with sample an integral characteristics of random variables and variants of limit theorems are derived (LLN, CLT). This knowledge is further applied to the statistical processing of observations and statistical parametric model estimation.			
01PRA2	Probability and Mathematical Statistics 2	ZK	2
The subject is devoted to the statistical techniques for estimation and testing within parametric and nonparametric models such as Maximum likelihood principle, Uniformly most powerful tests, Goodness of fitness tests of models, confidence regions, etc. We focus on real practical applications of these statistical techniques in frame of the specific examples.			
01PRST	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.			
01PRSTB	Probability and Statistics B	KZ	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.			
16UAZB	Principles of Ionizing-Radiation Applications	ZK	2
Historical outline of applications, review of interaction of radiation with a matter, radiation sources, detectors and instrumentation, evaluation of radionuclide measurements, use of penetration and scattering of radiation beams, selected radioanalytical methods, tracer methods, radionuclide dating, further possibilities for the use of ionizing radiation.			
16FNZB	Problems of Non-ionizing Radiation	ZK	2
Subject is focused on biological effects of non-ionizing radiation and its use in physical praxis. Information about principles, biological effects and methods used in fields of magnetic resonance and ultrasound as applied in various types of technical or medical equipment are given as well.			
12PSEM	Problem Seminary	Z	2
25 seminaries with topics from the region of solid materials engineering, physical electronics, materials science, nuclear reactors, dosimetry and application of ionizating radiation.			
01PROP	Programmer's Practicum	Z	2
The purpose of this course is to acquire good programming habits which will help in writing of clean code, i.e. such that is easy to comprehend by others and suitable for adding new functionality. Using specific examples, the students get familiar with naming conventions, and continue through writing project documentation, principles of defensive programming, debugging, up to creating object-oriented design, design patterns and refactoring.			

01PERI	Programming of Peripherals Devices	Z	2
Memory organization, input and output ports, computer bus. Software libraries for computer peripherals, 3D graphic libraries. Principles of peripherals device drivers.			
01PW	Windows Programming	Z	2
Simple graphical programs for MS Windows. Basic editing controls. File input and output. User defined components, dynamic type identification and reflection.			
18PRC1	Programming in C++ 1	Z	4
This course covers mainly the C programming language and non-object oriented features of the C++ language.			
18PRC2	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.			
18PJ	Programming in Java	Z,ZK	5
This course is devoted to the Java platform and to the development of the basic types of applications for this platform.			
18MTL	Programming in MATLAB	Z,ZK	5
Introducing Matlab environment as efficient tool for computation in complex arrays and symbolic variables, namely for linear algebra, mathematic analysis, statistics, algorithmization and geometric representation of results.			
18MPT	Programming in MATLAB	KZ	5
The subject acquaints students with various programming techniques in the Matlab environment. The emphasis is placed on the differences in programming methodology in Matlab compared to classical languages.			
18PAS	Pascal Programming	Z	4
This lecture 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 Pascal programming language.			
12PDR1	Data Communication and Interfaces 1	Z	2
Principles of computer networks, networks architectures and data transfer. Specification of existing network architectures.			
12PDR2	Data Communication and Interfaces 2	Z	2
Principles of Ethernet standards and basics of protocol suite TCP/IP.			
01PSL	LaTeX - Publication Instrument	Z	2
The course is devoted to the basics and facilities of computer typography, particularly to the system LaTeX			
00RET	Rhetoric	Z	1
The course is focused on the acquisition of speech and voice techniques and on the rules of correct pronounciation. The course is also devoted to the composition of public speech as well as to its nonverbal aspects. Stylistics exercises, strategies for coping with stage-fright and a short excursion into the history of rhetoric are an integral part of the course.			
01RMF	The Equations of Mathematical Physics	Z,ZK	6
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 (boundary value problem for eliptic PDE, mixed boundary problem for eliptic PDE).			
02RQGP1	Seminar on Quark-Gluon Plasma 1	Z	1
The aim of the seminar is discuss the selection of the most fundamental articles in heavy ion physics.			
02RQGP2	Seminar on Quark-Gluon Plasma 2	Z	1
The aim of the seminar is discuss the selection of the most fundamental articles in heavy ion physics.			
04RM1	Russian for Intermediate Students M1	Z	1
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.			
04RM2	Russian for Intermediate Students M2	Z	1
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.			
04RM3	Russian for Intermediate Students M3	Z	1
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.			
04RP1	Russian for Advanced Students P1	Z	1
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.			
04RP2	Russian for Advanced Students P2	Z	1
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.			
04RP3	Russian for Advanced Students P3	Z	1
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.			
04RZ1	Russian for Beginners Z1	Z	1
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.			
04RZ2	Russian for Beginners Z2	Z	1
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.			
04RZ3	Russian for Beginners Z3	Z	1
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.			

04RZ4	Russian for Beginners Z4	Z	1
The course is based on 04RZ3. 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.			
04RZ5	Russian for Beginners Z5	Z	1
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.)			
01RSWP	Project Management of Software Projects	KZ	2
The course Project management of software projects is dedicated to an explanation of general ideas, rules and procedures which are common to many projects of very diverse character. The course structure corresponds to a lifecycle of typical projects including many other aspects which have to be taken into account in the course of their management. Specific attention is paid to software project management and to IT projects in general. Interdisciplinary view of project management is emphasized.			
02SMF	Seminar of Mathematical Physics	Z	2
The purpose of the seminar is to iluminate mathematical physics by virtue of solved examples. It is supposed that the teachers of the physics department will present simple tasks concerning their scientific activities that could become the topics of the student?s bachelor theses in the next year			
01SSM1	Seminar of Contemporary Mathematics 1	Z	2
This seminar provides a different approach to those fields of mathematics that are included in curriculum but also to those that are not part of basic courses of mathematics.			
01SSM2	Seminar of Contemporary Mathematics 2	Z	2
This seminar provides a different approach to those fields of mathematics that are included in curriculum but also to those that are not part of basic courses of mathematics.			
16SED1	Dosimetry Seminar 1	Z	2
The seminary is supposed to motivate the student´s interest in the field of dosimetry. Since the students are usually not familiar with dosimetry, the seminary provides a review of possible fields of study and employment. First two lectures focus on the basics of radiation physics. The following lectures are given by the former students of DDAIR, who are currently employed in various organizations (SÚRO, v.v.i., ÚJF AV ČR v.v.i., ÚJV Řež, ČMI, Hospital Na Homolce, FN v Motole, PTC Czech s.r.o., CERN, Fermilab).			
16SED2	Dosimetry Seminar 2	Z	2
Dosimetry Seminary 2 follows-up SED1. In this seminary students will listen to the lectures of the older students of DDAIR. The older students give lectures about their progress on the research topic of their theses. The course also introduces the principles of creating good presentation and advice for working with scientific literature.			
01SMB1	Seminar on Calculus B1	Z	2
The course is devoted to support the lectures of Calculus B3.			
01SMB2	Seminar on Calculus B2	Z	2
The course is devoted to support the lectures of Calculus B4.			
01SOS1	Software Seminar 1	Z	2
Java, Java Beans, Assembly language programming for microprocessors Intel 80x86			
01SOS2	Software Seminar 2	Z	2
Graphical libraries GTK+ and Qt. Development of graphical user interface using C and C++ programming languages. Portable applications for Unix like operating systems, especially for Linux systems. Portability to Microsoft Windows.			
02SPRA1	Special Practicum 1	KZ	6
Physics measurement focused on instrumental techniques that are mainly used in physics and technical professions. Topics of each parts are chosen so that students can familiarize with advanced pats of experimental physics and metrology.			
02SPRA2	Special Practicum 2	KZ	6
Physics measurement focused on instrumental techniques that are mainly used in physics and technical professions. Topics of each parts are chosen so that students can familiarize with advanced pats of experimental physics and metrology.			
01STR	Statistical Decision Theory	ZK	2
The subject is devoted to the statistical techniques for general decision procedures based on optimization of suitable stochastic criterion, their mutual comparisons with respect to their properties and applicability.			
11SFBM	Structure and Function of Biomolecules	Z,ZK	3
Knowledge of macromolecular structure is crucial for the understanding of its function. The subject is focused on the introduction to building blocks of macromolecules, overall structure and its structure:function relationship including macromolecular complexes.			
04SM1	Spanish for Intermediate Students M1	Z	1
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 (e.g., 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 everyday or easy subtechnical topic, for which the students are trained by reading texts or listening to them.			
04SM2	Spanish for Intermediate Students M3	Z	1
The course develops the students´ knowledge from the previous course (SM1). Students are gradually acquainted with fundamentals of Spanish for specific purposes in order to be able to work with specialized texts on the Internet.			
04SM3	Spanish for Intermediate Students M3	Z	1
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.			
04SP1	Spanish for Advanced Students P1	Z	1
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.			
04SP2	Spanish for Advanced Students P2	Z	1
Course SP2 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.			
04SP3	Spanish for Advanced Students P3	Z	1
Course 04SP3 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.			

04SZ1	Spanish for Beginners Z1	Z	1
Course 04SZ1 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.			
04SZ2	Spanish for Beginners Students Z2	Z	1
Course 04SZ2 is based on course 04SZ1, 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.			
04SZ3	Spanish for Beginners Z3	Z	1
The course is based on course SZ2, and develops the student´s vocabulary and grammar structure. The course covers realia (history and culture) of the Spanish-speaking countries, mainly of Spain. It pays attention to further grammar topics (pretérito perfecto, pretérito indefinido, pretérito imperfecto, the gerund and the imperative). It includes written and oral communication on a given general topic, for which the student is trained by reading texts or listening to them.			
04SZ4	Spanish for Beginners Z3	Z	1
The course is based on course SZ3. 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.			
04SZ5	Spanish for Beginners Z5	Z	1
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 presentations and, finally, a written and oral examination.			
14TM	Engineering Mechanics	Z,ZK	4
The course represents a link-up between the theoretical mechanics of rigid bodies and engineering disciplines dealing with the stress and strain analysis of real structure parts.			
14TEM	Engineering Mechanics	Z,ZK	6
Abstract: The course represents a link-up between the theoretical mechanics of rigid bodies and engineering disciplines dealing with stress and strain analysis of real structure parts (elasticity, plasticity, fracture mechanics, etc.). Principles of statics, kinematics, and dynamics and their application.			
12TAIS	Ion Beam Techniques and Applications.	ZK	3
Production and forming of ion beam, charged particle optics, interaction of ion with solid matter, technological and analytical applications.			
TV-1	Physical Education	Z	1
TV-2	Physical Education	Z	1
TV-3	Physical education	Z	1
TV-4	Physical education	Z	1
02TEF1	Theoretical Physics 1	Z,ZK	4
The course is an introduction to analytical mechanics. The students acquire knowledge of the basic concepts of theLagrange formalism. The efficiency of this method is illustrated on elementary examples like the two-bodyproblem, the motion of a system of constrained mass points, and of a rigid body. Advanced parts of the coursecover differential and integral principles of mechanics. The subject is the first part of the course of classicaltheoretical physics (02TEF1, 02TEF2).			
02TEF2	Theoretical Physics 2	Z,ZK	4
The Hamilton formalism. The special theory of relativity: relativistic mechanics and classical field theory in theMinkowski space-time. Classical electrodynamics: Maxwell's equations in the Minkowski space-time,electromagnetic waves in dielectric media, electromagnetic radiation in the dipole approximation.			
01DYSY	Theory of Dynamic Systems	ZK	3
The course provides an introduction to system theory with emphasis on control theory and understanding of the fundamental concepts of systems and control theory. First, we build up the understanding of the dynamical behavior of systems as well as provide the necessary mathematical background. Internal and external system descriptions are described in detail, including state variable, impulse response and transfer function, polynomial matrix, and fractional representations. Stability, controllability, observability, and realizations are explained with the emphasis always being on fundamental results. State feedback, state estimation, and eigenvalue assignment are discussed in detail. All stabilizing feedback controllers are also parameterized using polynomial and fractional system representations. The emphasis in this primer is on linear time-invariant systems, both continuous and discrete time.			
01TKO	Theory of Codes	ZK	2
Algebraic methods used in error detecting and error correcting codes.			
02TER	Heat and Molecular Physics	Z,ZK	4
Thermal expansion of materials, heat transfer; stationary and non-stationary heat conduction, heat transfer and penetration; 1st and 2nd thermodynamic principle, ideal and real gas, entropy; non-chemical systems: dielectric and magnetic materials; Maxwell relations and thermodynamic potentials; kinetic theory: Maxwell's velocity distribution,equipartition theorem.			
02TSFA	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.			
01TOP	Topology	ZK	2
The aim of lecture is the systematization and deepening the knowledge of general topology.			
16MCRB	Transport of Ionizing Radiation and Monte Carlo Method	Z,ZK	4
Introduction to principles of Monte Carlo method and its use for radiation transport simulation, selected concepts of probability theory and mathematical statistics. Physical models of interaction of different types of radiation and their use for stochastic modeling of their substance transport. Model description concepts, geometric model layout, source term, scoring methods, and modeling of measured variables and parameters. Statistical evaluation of reliability of modeling results, variance reduction methods, program codes and tools for radiation transport modeling, MCNP program, its possibilities and use. Procedures for the practical use of the program for typical tasks in the field of dosimetry, application of ionizing radiation, detection and detection systems, radiation protection and medical applications.			
18INTA	Generation of Internet Applications	KZ	4
WWW principles (HTTP, URL, client-server, HTML, CSS), fundamentals of WWW pages generation, server technologies for internet applications, PHP - hypertext preprocessor: syntax, variables, statements, user functions, arrays, regular expressions, working with files, working with database, working with objects, working with images, e-mail, security, examples of internet applications.			
01DYK	Introduction to Continuum Dynamics	Z	2
This course is an introduction to the mathematical description of continuum dynamics. It summarizes the necessary mathematical apparatus with emphasis on vector and tensor calculus, differential forms, and integration on manifolds. It includes the basic concepts of continuum mechanics such as strain and stress tensors or substantial derivative, by means of which it is possible to derive the fundamental laws of conservation of mass, momentum, angular momentum, and energy in integral and differential form. In the last part of the course, these conservation laws are adapted to the case of viscous and inviscid fluid and linear and nonlinear elastic body.			
16ZIVB	Introduction to Ecology	KZ	2
The subject inform about basic of the ecologic principles, terms and ideas. It covers overview information regarding to particular components of the environment and evaluate economic indicators and sustainable development.			

02UFEC	Introduction to Elementary Particle Physics	Z	2
The course provides an easily accessible introduction to elementary particle physics. Development, methods, goals and perspectives of the subject are presented.			
11UFPLN	Introduction to Solid State Physics	ZK	2
The purpose of this lecture is to introduce the undergraduate students to the study of the solid state physics.			
17UINZ	Introduction to Engineering	Z,ZK	3
The course is devoted to an introduction to the engineering profession. Students will gradually learn the characteristics and specialties of engineering work, including an overview of the basics of selected engineering disciplines, such as the basics of materials science, manufacturing technology, quality control and assurance and ecology. Further, the course will focus on some issues of R&D activities organization and on selected parts of technical drawings and the work with AutoCAD code.			
02UKP	Introduction to Curves and Surfaces	Z	2
The goal of the lecture is an introduction to the differential geometry of simple manifolds - curves and two-dimensional surfaces. The basic concepts for the curves are introduced Frenets formulae are explained. In the surface theory we introduce first and second fundamental forms and mean and Gaussian curvature. Essential part of the lecture are the examples calculated by students			
12UMF	Introduction to Modern Physics	Z	3
The course is intended to be a concise introduction to modern / nonclassical physics for students who have already had basic classical physics course. A part of the course is delivered in a computational laboratory.			
18UOA	Introduction into Object Oriented Architecture	Z,ZK	4
00UPRA	Introduction to Law	Z	1
00UPSY	Introduction to Psychology	Z	1
01UTIZ	Introduction to Theoretical Informatics	ZK	2
11UVOD	Introduction to Specialization	Z	2
The purpose of this lecture is to introduce the undergraduate students to the physical master degree study programmes.			
12VAK	Vacuum Physics and Technology	KZ	4
Rarefied gasses: basic concepts and relations; flow of rarefied gas. Interaction of gas with surface of solid surface; sorption, desorption; evaporation, condensation; gas transport through solid matter; Vacuum generation. Pumping process. Pumps.Vacuum measurements: vacuum gauges of total and partial pressure; pumping speed; gas flow, conductivity, searching for leaks. Materials and vacuum instalation parts. Practical exercises.			
12PYTH	Scientific Programming in Python	Z	2
The aim of this course is to learn the fundamentals of the modern Python programming language with a focus on scientific computing. Emphasis is placed on effective solutions to real problems. The course is performed in an interactive form of practical exercises, whose topics can be tailored to the content of other subjects or student theses. Students are also involved in ongoing research. In the introductory part of the course, students learn the basic features of Python?from basic types to object oriented or functional programming. The greater part of the course focuses on specific features of Python for scientific programming. Presented are the main numerical libraries NumPy, SciPy and the Matplotlib graphics library. We show how to generate efficient code, how to combine Python with other languages, what tools are available.			
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.			
17VYR	Research Reactors	ZK	2
Course is devoted to research reactors and their applications for the need of research and industry. Students get familiar with research reactor types and their experimental programme along with experimental equipment needed for particular applications and their specifics. The course is supported by technical visit to research reactor workplace.			
18ZALG	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.			
16AMMB	Fundamentals of Analytical Measurement Methods	ZK	2
Basic principles, technical performance and utilization of methods of chemical analysis. Basic methodology of analytical determination, gravimetry, titration methods, potentiometry, polarography, refractometry, polarimetry, UV-VIS spectroscopy, atomic emission and absorption spectroscopy, infrared and Raman spectroscopy, X-ray structural analysis, nuclear magnetic and electron spin resonance, mass spectrometry, thermometric methods, gas and liquid chromatography.			
16ZBAF1	Fundamentals of Human Biology, Anatomy and Physiology 1	Z,ZK	4
Organization of living systems, non-cellular and cellular organisms, prokaryotic and eukaryotic cell. Molecular and cell biology. Biopolymers. Molecular genetics. Cell cycle, mitosis, their regulation. General human anatomy. Basics of medical terminology. Overview of tissues. Skeleton. Muscle anatomy in general. Digestive system and its physiology. Respiratory system and physiology of respiration. Excretory and genital tract.			
16ZBAF2	Fundamentals of Human Biology, Anatomy and Physiology 2	Z,ZK	4
Heart and physiology of cardiac activity. General anatomy of blood vessels, main arteries of the body, overview of veins and physiology of blood, blood clotting. Overview of nerves. CNS. Visual system and physiology of the visual system. Auditory and vestibular system and physiology of hearing and balance. Skin, endocrine glands.			
16ZDOZ1	Fundamentals of Radiation Dosimetry 1	Z,ZK	4
History, development, and objectives of dosimetry. Quantities and units used for description of sources, fields, interactions of ionizing radiation, ionizations, energy transfer and absorption. Fundamentals of the effects of ionizing radiation.			
16ZDOZ2	Fundamentals of Radiation Dosimetry 2	ZK	2
Fundamentals of biological effects of ionizing radiation. Quantities and units used in radiation protection. Recommendations of ICRP and ICRU. Principles and methods of measurements in dosimetry. Determination of activity and neutron source emission. Measurements of absorbed dose and exposure.			
17ZEH	Basics of Economic Assessment	ZK	2
The course focuses on the economic evaluation of Nuclear power plants. Introductory lectures are concerned with an introduction to economy and the basic component parts of microeconomics. Lectures continued with insight into the business and managerial economics, explanation of the concepts of incomes, expenses, etc. and their applications in electrical energy resources evaluation. Second part of lectures is focused on evaluation of nuclear power plants - the fuel cycle and operations of NPP.			
17ZEL	Basics of Electronics	KZ	3
Lectures provide basic information of electronics. In the beginning, lectures are devoted to passive components - resistors, capacitors, inductors and solution of electrical circuits with them. Next, lectures deal with semiconductor components (standard, Zener, capacitive, LED), bipolar, unipolar transistors and semiconductor components with more layers (thyristors and triacs). Lectures continue with general amplifiers and operational amplifiers. Finally, lectures deal with digital circuits, digital/analog and analog/digital converters. Lectures are completed with electronic laboratory exercises.			
02ZFM1	Foundations of Physical Measurements 1	Z	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 introducethe basics of physical measurements, the methods of processing and evaluation of acquired data on a PC. Studentslearn the basic habits of work in a physics lab.			

02ZFM2	Foundations of Physical Measurements 2	Z	2
This introductory course is devoted to the essentials of measurements of the most important physical quantities. It is especially recommended to those students who are going to study one of the physicas curricula - Physical engineering and Nuclear engineering. Also the methods of evaluation of statistical data using PC and practical work with measurement devices is involved. Students learn main rules connected with experimental work in physical laboratory.			
11ZFPL	Basic to Solid State Physics	KZ	2
The purpose of this lecture is to introduce the undergraduate students to the study of the physical properties of solid state.			
12ZFP	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. Fokker-Planck collision term is derived. Basics of atomic physics od multiply-ionized plasmas are introduced.			
02ZJF	Nuclear Physics	Z,ZK	6
This scientific field presents formidable challenges both experimentally and theoretically, simply because we are dealing with the submicroscopic domain, where much of our classical intuition regarding the behaviour of objects fails us. The lecture is a basic introduction to very interesting regions of subatomic physics.			
02ZJFB	Nuclear Physics B	KZ	3
This scientific field presents formidable challenges both experimentally and theoretically, simply because we are dealing with the submicroscopic domain, where much of our classical intuition regarding the behaviour of objects fails us. The lecture is a basic introduction to very interesting regions of subatomic physics.			
15ZKJE	Nuclear Power Plants Design and Operation	ZK	3
Target of lecture is to create basic knowledge of physics of nuclear reactors utilizing fission. Further explains arrangement of nuclear fuel, purpose, technological and material construction of core. Function and construction of all components are defined wit regard to nuclear physics, physics of shielding, theory of regulation, material science, chemistry, heat transfer and dosimetry. Creates knowledge for evaluation of nuclear safety and radiation protection in nuclear energy, reliability and economy for comparison with other sources of energy, to environment and to strategic importancy of nuclear sources of energy. Gives basic knowledge of construction, operation and decommissioning of nuclear power stations. Informs about high level nuclear waste and spent fuel and their management.			
16MEZB	Fundamentals of Ionizing-Radiation Metrology	Z,ZK	4
The course summarizes the basic objectives and content of ionizing radiation metrology. It deals with the interpretation of radiation quantities and units in metrology. It summarizes the theoretical and experimental foundations of metrology, the determination of basic parameters of radiation. Lectures are supplemented with basic summary of relevant legislation and regulations.			
01ZOS	Introduction to Operating Systems	Z	2
Introduction to structure of operating systems. Processes, thread, memory management. Synchronization of multi=threaded applications. Memory mapped files.			
01ZPB1	Introduction to Computer Security 1	Z	2
16ZRAO	Basics of Radiation Protection	Z	2
The aim of the course is to familiarize students with the general principles of radiation protection. The main emphasis is put on basic mechanisms and concepts, in order to allow critical orientation in this field. The course provides answers to the cardinal questions: What is ionizing radiation (IR), where it comes from, whether and how it is dangerous for people, what is the meaning of protective units (Gray, Sievert), how to prevent malicious effect of IR and many others. The content of the lectures does not require any prior knowledge.			
02ZSM	Introduction to the Standard Model	ZK	2
Particles, leptons, hadrons, baryons, mesons, symmetry, symmetry group, quarks, gluons, partons, standard model of electroweak and strong interactions, quantum chromodynamics (QCD), cross section, scattering cross section.			
16ZEDB	Basics of Experimantal Data Processing	ZK	2
Statistical analysis of experimental data; univariate data; calibration; regression; multivariate data.			
14ZZKS	Testing and Processing of Metals and Alloys	KZ	4
Abstract: Tension tests, hardness, impact toughness, technological testing, fatigue testing, creep testing. Light microscopy, preparation of specimens for macro- and micro-observation. Casting, forming, welding, soldering, brazing, powder metallurgy, mechanical machining. Copper alloys, aluminium alloys, titanium alloys, special alloys of non-ferrous metals. Technical drawing and CAD.			
12ZDP	Data Processing for Publishing	Z	2
Typography, computer computer-assisted publishing, coding of text, OCR (optical code recognition), DTP (desk top publishing), programming languages for typesetting (TeX, LaTeX, HTML, XML,..., publishing into www pages, cloud computing,commonly used graphical formats, formatting of typical data (PDF, PS, DOC, DOCX, PPS, PPSX, RFT, XLS, XLSX), multimedial presentations, multimedial formats.			

List of courses of this pass:

Code	Name of the course	Completion	Credits
00EKOT	Economy in Technology	Z	1
The course introduces the basics of micro- and macroeconomics.			
00MAM1	Essentials of High School Course 1	Z	1
00MAM2	Essentials of High School Math Course 2	Z	1
Review of basics of high school mathematics.			
00PT	Preparatory Week	Z	2
00RET	Rhetoric	Z	1
The course is focused on the acquisition of speech and voice techniques and on the rules of correct pronounciation. The course is also devoted to the composition of public speech as well as to its nonverbal aspects. Stylistics exercises, strategies for coping with stage-fright and a short excursion into the history of rhetoric are an integral part of the course.			
00UPRA	Introduction to Law	Z	1
00UPSY	Introduction to Psychology	Z	1
01ALG	Algebra	ZK	4
After an introduction into the set theory standard algebraic structures are dealt with: groups, rings, fields, modules, linear algebras, lattices, Boolean algebras, rings of polynomials over commutative fields.			

01ALGE	Algebra	Z,ZK	6
Firstly, the Peano axioms are treated in detail. Elements of the set theory cover only: equivalence and subvalence, the Cantorov-Bernstein theorem, the axiom of choice and equivalent statements, definition of ordinals and cardinals. Further standard algebraic structures are addressed: semigroups, monoids, groups, rings, integral domains, principal ideal domains, fields, lattices. Independent chapters are devoted to divisibility in integral domains and to finite fields.			
01DEM	History of Mathematics	Z	1
The subject has the form of regular seminars where the members of the department of mathematics, but also invited speakers - specialists in the field - give their talks on varoius topics from the history of mathematics.			
01DIM1	Discrete Mathematics 1	Z	2
The seminar is devoted to elementary number theory and applications. It includes individual problem solving.			
01DIM2	Discrete Mathematics 2	Z	2
The seminar is devoted to recurrence relations. It includes individual problem solving.			
01DIM3	Discrete Mathematics 3	Z	2
The subject is devoted to elementary proofs of non-trivial combinatoriwal identities and to generating functions and their applications. In the seminar students present a problem with solution chosen from the given literature.			
01DYK	Introduction to Continuum Dynamics	Z	2
This course is an introduction to the mathematical description of continuum dynamics. It summarizes the necessary mathematical apparatus with emphasis on vector and tensor calculus, differential forms, and integration on manifolds. It includes the basic concepts of continuum mechanics such as strain and stress tensors or substantial derivative, by means of which it is possible to derive the fundamental laws of conservation of mass, momentum, angular momentum, and energy in integral and differential form. In the last part of the course, these conservation laws are adapted to the case of viscous and inviscid fluid and linear and nonlinear elastic body.			
01DYSY	Theory of Dynamic Systems	ZK	3
The course provides an introduction to system theory with emphasis on control theory and understanding of the fundamental concepts of systems and control theory. First, we build up the understanding of the dynamical behavior of systems as well as provide the necessary mathematical background. Internal and external system descriptions are described in detail, including state variable, impulse response and transfer function, polynomial matrix, and fractional representations. Stability, controllability, observability, and realizations are explained with the emphasis always being on fundamental results. State feedback, state estimation, and eigenvalue assignment are discussed in detail. All stabilizing feedback controllers are also parameterized using polynomial and fractional system representations. The emphasis in this primer is on linear time-invariant systems, both continuous and discrete time.			
01FA1	Functional Analysis 1	Z,ZK	3
Continuing course of mathematical analysis and algebra introduction to the basics of functional analysis. There are the concepts that students need to understand the various physical and technical disciplines.			
01FA2	Functional Analysis 2	Z,ZK	4
The course aims to present selected fundamental results from functional analysis including basic theorems of the theory of Banach spaces, closed operators and their spectrum, Hilbert-Schmidt operators, spectral decomposition of bounded self-adjoint operators.			
01FAN1	Functional Analysis 1	Z,ZK	4
Basic notions and results are addressed concerning successively topological spaces, metric spaces, topological vector spaces, normed and Banach spaces, Hilbert spaces.			
01FKP	Functions of Complex Variable	ZK	2
The course develops advanced properties of systems of holomorphic functions, Ascoli-Vitali's theorem, advanced properties of conformal mappings, transcendental and meromorphic functions. Basic properties of complex functions of several complex variables together with improper line integrals and its applications are presented.			
01FKPB	Functions of Complex Variable B	Z	2
The course develops advanced properties of systems of holomorphic functions, Ascoli-Vitali's theorem, advanced properties of conformal mappings, transcendental and meromorphic functions. Basic properties of complex functions of several complex variables together with improper line integrals and its applications are presented.			
01GTDR	Geometric Theory of Ordinary Differential Equations	Z	2
The seminar consists of the qualitative theory of ODEs dealing with the geometric and topological properties of the solution. In this context, we mention suitably formulated basic results of the existence and uniqueness, continuous dependence on parameters and initial conditions. Main part is devoted to the autonomous systems.			
01JEPR	Simple Compilers	Z	2
Lexical and syntax analysis, code generation, simple optimizations, development environments, reflection.			
01LAB2	Linear Algebra B2	Z,ZK	4
The subject summarizes the most important notions and theorems related to the matrix theory, to the study of vector spaces with a scalar product and to the linear geometry.			
01LAL	Linear Algebra 1	Z	2
01LALB	Linear Algebra B 1, Examination	ZK	3
01LIP	Linear Programming	Z,ZK	3
We study special problems about constrained extremum problems for multivariable functions (the function is linear and the constraint equations are given by linear equations and linear inequalities).			
01MAB2	Calculus B2	Z,ZK	7
Basic calculus (real analysis, indefinite and definite integrals and series).			
01MAB3	Calculus B3	Z,ZK	7
The course is devoted to functional sequences and series, theory of ordinary differential equations, theory of quadratic forms and surfaces, and general theory of metric spaces, normed and prehilbert?s spaces.			
01MAB4	Calculus B4	Z,ZK	7
The course is devoted properties of functions of several variables, differential and integral calculus. Furthermore, the measure theory and theory of Lebesgue integral is studied.			
01MAN	Calculus 1	Z	4
Basic calculus (real analysis, functions of one real variable, differential calculus).			
01MANB	Calculus B 1, Examination	ZK	4
Examination of knowledge about stuff lectured in the 01MAN course.			
01MAPR	Markov processes	Z,ZK	4
01MASC	Mathematical Statistics - Seminar	Z	2
The subject is devoted to practical use of statistical methods studied in the course Mathematical Statistics 01MAS. The tutorial deals with calculation of Fisher information matrix of statistical models, finding unbiased estimators with minimal variance, parameter estimation by method of moments and method of maximum likelihood, derivation of critical regions for hypothesis testing using the Neyman-Pearson lemma and likelihood ratio, calculation of confidence intervals and non-parametric density estimation.			
01MAT1	Mathematics 1	Z	4
The course is devoted to the study of the basics of calculus of one variable. It includes an introduction to differential and integral calculus, with particular emphasis on applications in practical problems.			

01MAT2	Mathematics 2	Z	4
The course, which is the continuation of Mathematics 1, is devoted to the integration techniques, improper Riemann integral, introduction to parametric curves (especially in polar coordinates), the basics of sequences and infinite series, and finally to the Taylor and power series and their applications.			
01MAT3	Mathematics 3	Z,ZK	4
The subject summarises the most important notions and theorems related to the study of finite-dimensional vector spaces.			
01MAT4	Mathematics 4	Z,ZK	4
Linear and non-linear differential equations of the first order. Linear differential equations of higher order with constant coefficients. Multivariable calculus and its applications.			
01MATZ1	Mathematics, Examination 1	ZK	2
01MATZ2	Mathematics, Examination 2	ZK	2
01MMF	Methods of Mathematical Physics	Z,ZK	6
The course provides an introduction to the theory of distributions with applications to solutions of partial differential equations with constant coefficients, further the Fredholm theorems are discussed for the case of a continuous kernel on a compact set as well as Sturm-Liouville operators on bounded intervals, and applications of the separation of variables method to the solution of some boundary value problems and mixed problems.			
01MMPV	Mathematical Models of Groundwater Flow	KZ	2
The course provides an overview of computational methods for selected groundwater flow problems. The first part of the course is devoted to mathematical formulations of these problems. The second part is aimed at selected numerical methods, emphasizing implementation issues related to these methods.			
01NME2	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.			
01PERI	Programming of Peripherals Devices	Z	2
Memory organization, input and output ports, computer bus. Software libraries for computer peripherals, 3D graphic libraries. Principles of peripherals device drivers.			
01POGR1	Computer Graphics 1	Z	2
The first part of the two-semester "Computer Graphics" course is devoted to the specifics of digital display devices spanning from history up to the state of the art technologies. Further, a survey of fundamental problems in 2D computer graphics is given together with their solutions. Focus is put on mathematical description of problems and explanation of the corresponding algorithms using knowledge previously obtained in a variety of subjects available at FNSPE. The final part of the course covers the applications of computer graphics approaches in the process of authoring scientific documents and presentations.			
01POGR2	Computer Graphics 2	Z	2
The second part of the two-semester "Computer Graphics" course begins with a brief introduction to signal theory in the context of aliasing - a phenomenon ubiquitous in computer graphics. Further, a well structured survey of fundamental problems in 3D computer graphics is given together with their solutions, from the description of a 3D scene to its realistic rendering. Focus is put on mathematical description of problems and explanation of the corresponding algorithms using knowledge previously obtained in a variety of subjects available at FNSPE. The algorithm implementation aspect such as data structures design etc. is also a matter of concern. In the last lecture, a number of theoretical concepts are demonstrated using Blender, an open-source 3D modeling and rendering software instrument.			
01POPJ1	Computers and Natural Language 1	Z	2
Basic course of computational processing and understanding of natural languages. Automatic methods of morphological and syntactic analysis including modern statistical methods of result disambiguation will be discussed. Two-level morphology, tagging and language models, Viterbi algorithm, grammars, chart parsing, probabilistic grammars.			
01POPJ2	Computers and Natural Language 2	Z	2
The goal of the course is to get acquainted with the broad topic of machine translation (MT). Machine translation is a challenging task that can serve as a good example for modeling of systems as complex as natural languages. We cover several rather different approaches to the task as well as issues related to automatic and manual evaluation of translation quality.			
01POPR	Advanced Probability	Z	2
The subject is devoted to advanced Theory of probability and statistics on measure-theoretic level for general distributions of random variables. We deal with sample and integral characteristics of random variables and convergence criteria. Further, the theory of statistical model estimation and testing is extended for parametric and nonparametric cases.			
01PRA1	Probability and Mathematical Statistics 1	Z,ZK	6
The subject is devoted to the introduction to Theory of probability and statistics on measure-theoretic level for discrete models, continuous distributions and general distributions of random variables. We deal with sample an integral characteristics of random variables and variants of limit theorems are derived (LLN, CLT). This knowledge is further applied to the statistical processing of observations and statistical parametric model estimation.			
01PRA2	Probability and Mathematical Statistics 2	ZK	2
The subject is devoted to the statistical techniques for estimation and testing within parametric and nonparametric models such as Maximum likelihood principle, Uniformly most powerful tests, Goodness of fitness tests of models, confidence regions, etc. We focus on real practical applications of these statistical techniques in frame of the specific examples.			
01PROP	Programmer's Practicum	Z	2
The purpose of this course is to acquire good programming habits which will help in writing of clean code, i.e. such that is easy to comprehend by others and suitable for adding new functionality. Using specific examples, the students get familiar with naming conventions, and continue through writing project documentation, principles of defensive programming, debugging, up to creating object-oriented design, design patterns and refactoring.			
01PRST	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.			
01PRSTB	Probability and Statistics B	KZ	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.			
01PSL	LaTeX - Publication Instrument	Z	2
The course is devoted to the basics and facilities of computer typography, particularly to the system LaTeX			
01PW	Windows Programming	Z	2
Simple graphical programs for MS Windows. Basic editing controls. File input and output. User defined components, dynamic type identification and reflection.			
01RMF	The Equations of Mathematical Physics	Z,ZK	6
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 (boundary value problem for eliptic PDE, mixed boundary problem for eliptic PDE).			

01RSWP	Project Management of Software Projects	KZ	2
The course Project management of software projects is dedicated to an explanation of general ideas, rules and procedures which are common to many projects of very diverse character. The course structure corresponds to a lifecycle of typical projects including many other aspects which have to be taken into account in the course of their management. Specific attention is paid to software project management and to IT projects in general. Interdisciplinary view of project management is emphasized.			
01SITE1	Computer Networks 1	Z	2
Understanding the history and present network (LAN, WAN, use the principles and technologies). Architecture of reference model ISO/OSI. Network protocols, practical exercises with TCP/IP communications. Internet services - mail, remote access, www. Secure communication, tunneling. Directory services, certificates, certification authorities, public key infrastructure (PKI). Use in practice. Network security - firewalls (packet filters, proxies, gateways, NAT, DMZ), practical exercises. (According to the interest - the serial control lines, modems)			
01SITE2	Computer Networks 2	Z	2
Understanding the history and present network (LAN, WAN, use the principles and technologies). Architecture of reference model ISO/OSI. Network protocols, practical exercises with TCP/IP communications. Internet services - mail, remote access, www. Secure communication, tunneling. Directory services, certificates, certification authorities, public key infrastructure (PKI). Use in practice. Network security - firewalls (packet filters, proxies, gateways, NAT, DMZ), practical exercises. (According to the interest - the serial control lines, modems)			
01SMB1	Seminar on Calculus B1	Z	2
The course is devoted to support the lectures of Calculus B3.			
01SMB2	Seminar on Calculus B2	Z	2
The course is devoted to support the lectures of Calculus B4.			
01SOS1	Software Seminar 1	Z	2
Java, Java Beans, Assembly language programming for microprocessors Intel 80x86			
01SOS2	Software Seminar 2	Z	2
Graphical libraries GTK+ and Qt. Development of graphical user interface using C and C++ programming languages. Portable applications for Unix like operating systems, especially for Linux systems. Portability to Microsoft Windows.			
01SSM1	Seminar of Contemporary Mathematics 1	Z	2
This seminar provides a different approach to those fields of mathematics that are included in curriculum but also to those that are not part of basic courses of mathematics.			
01SSM2	Seminar of Contemporary Mathematics 2	Z	2
This seminar provides a different approach to those fields of mathematics that are included in curriculum but also to those that are not part of basic courses of mathematics.			
01STR	Statistical Decision Theory	ZK	2
The subject is devoted to the statistical techniques for general decision procedures based on optimization of suitable stochastic criterion, their mutual comparisons with respect to their properties and applicability.			
01TKO	Theory of Codes	ZK	2
Algebraic methods used in error detecting and error correcting codes.			
01TOP	Topology	ZK	2
The aim of lecture is the systematization and deepening the knowledge of general topology.			
01UTIZ	Introduction to Theoretical Informatics	ZK	2
01ZOS	Introduction to Operating Systems	Z	2
Introduction to structure of operating systems. Processes, thread, memory management. Synchronization of multi=threaded applications. Memory mapped files.			
01ZPB1	Introduction to Computer Security 1	Z	2
02AMS	Atomic and Molecular Spectroscopy	Z,ZK	4
The lecture is devoted to atomic and molecular spectroscopy.			
02DEF1		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.			
02DEF2	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.			
02DRG	Differential Equations, Symmetries and Groups	Z	4
The purpose of the lecture is to teach students computation of symmetries of the differential equations.			
02ELMA	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			
02EXF1	Experimental Physics 1	Z	2
Lecture represents an introductory course in experimental physics. Students will learn methods of measurement of basic physical quantities and methods of measurement evaluation.			
02EXF2	Experimental Physics 2	ZK	2
Lecture represents an introductory course in experimental physics. Students will learn methods of measurement of basic physical quantities and methods of measurement evaluation.			
02FYS1	Physical Seminar 1	Z	2
The seminar is devoted to detailed study of interesting physical problems. It should help students to deeper understanding of fundamentals of physics presented in the course of Mechanics. The problems are chosen, studied and presented by the students themselves, with the possibility to use PC and physical laboratory equipments.			
02FYS2	Physical Seminar 2	Z	2
The seminar is devoted to detailed study of interesting physical problems. It should help students to deeper understanding of fundamentals of physics presented in the course of Electricity and Magnetism. The problems are chosen studied and presented by the students themselves, with the possibility to use PC and physical laboratory equipments.			
02KF	Quantum Physics	Z,ZK	3
State description, wave function, postulates of quantum mechanics, Born s statistical interpretation, expectation values, Schrödinger equation, Heisenberg uncertainty principle, quantization of angular momentum, solution of simple systems, hydrogen atom.			
02LCF1	Experimental Laboratory 1	Z	2
Cavendish experiment. Elasticity.Thermal capacities. Electric measurements, Acoustic. Oscillations.			
02LCF2	Experimental Laboratory 2	Z	2
Electric and magnetic field, microwaves, Xray and gamma rays, geometric optics			

02MECH	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.			
02MECHZ	Mechanics - Examination	ZK	2
The content of the subject is the examination according to the plan of studies.			
02NSAD	Simulations and Data Analysis Tools	Z	2
Data analysis and simulations of high energy elementary particle collisions. ROOT and Pythia programs.			
02OR	General Relativity	ZK	3
Introduction to general theory of relativity: principle of equivalence and principle of general covariance, parallel transport and geodesic equation, gravitational redshift. Curvature and Einstein's gravitational law. Schwarzschild solution of the Einstein equations, homogeneous and isotropic cosmological models.			
02PRA1	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.			
02PRA2	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.			
02RQGP1	Seminar on Quark-Gluon Plasma 1	Z	1
The aim of the seminar is discuss the selection of the most fundamental articles in heavy ion physics.			
02RQGP2	Seminar on Quark-Gluon Plasma 2	Z	1
The aim of the seminar is discuss the selection of the most fundamental articles in heavy ion physics.			
02SMF	Seminar of Mathematical Physics	Z	2
The purpose of the seminar is to iluminate mathematical physics by virtue of solved examples. It is supposed that the teachers of the physics department will present simple tasks concerning their scientific activities that could become the topics of the student?s bachelor theses in the next year			
02SPRA1	Special Practicum 1	KZ	6
Physics measurement focused on instrumental techniques that are mainly used in physics and technical professions. Topics of each parts are chosen so that students can familiarize with advanced pats of experimental physics and metrology.			
02SPRA2	Special Practicum 2	KZ	6
Physics measurement focused on instrumental techniques that are mainly used in physics and technical professions. Topics of each parts are chosen so that students can familiarize with advanced pats of experimental physics and metrology.			
02TEF1	Theoretical Physics 1	Z,ZK	4
The course is an introduction to analytical mechanics. The students acquire knowledge of the basic concepts of theLagrange formalism. The efficiency of this method is illustrated on elementary examples like the two-bodyproblem, the motion of a system of constrained mass points, and of a rigid body. Advanced parts of the coursecover differential and integral principles of mechanics. The subject is the first part of the course of classicaltheoretical physics (02TEF1, 02TEF2).			
02TEF2	Theoretical Physics 2	Z,ZK	4
The Hamilton formalism. The special theory of relativity: relativistic mechanics and classical field theory in theMinkowski space-time. Classical electrodynamics: Maxwell's equations in the Minkowski space-time,electromagnetic waves in dielectric media, electromagnetic radiation in the dipole approximation.			
02TER	Heat and Molecular Physics	Z,ZK	4
Thermal expansion of materials, heat transfer; stationary and non-stationary heat conduction, heat transfer and penetration; 1st and 2nd thermodynamic principle, ideal and real gas, entropy; non-chemical systems: dielectric and magnetic materials; Maxwell relations and thermodynamic potentials; kinetic theory: Maxwell's velocity distribution,equipartition theorem.			
02TSFA	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.			
02UFEC	Introduction to Elementary Particle Physics	Z	2
The course provides an easily accessible introduction to elementary particle physics. Development, methods, goals and perspectives of the subject are presented.			
02UKP	Introduction to Curves and Surfaces	Z	2
The goal of the lecture is an introduction to the differential geometry of simple manifolds - curves and two-dimensional surfaces. The basic concepts for the curves are introduced Frenets formulae are explained. In the surface theory we introduce first and second fundamental forms and mean and Gaussian curvature. Essential part of the lecture are the examples calculated by students			
02ZFM1	Foundations of Physical Measurements 1	Z	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 introducethe basics of physical measurements, the methods of processing and evaluation of acquired data on a PC. Studentslearn the basic habits of work in a physics lab.			
02ZFM2	Foundations of Physical Measurements 2	Z	2
This introductory course is devoted to the essentials of measurements of the most important physical quantities. It is especially recommended to those students who are going to study one of the physicas curricula - Physical engineering and Nuclear engineering. Also the methods of evaluation of statistical data using PC and practical work with measurement devices is involved. Students learn main rules connected with experimental work in physical laboratory.			
02ZJF	Nuclear Physics	Z,ZK	6
This scientific field presents formidable challenges both experimentally and theoretically, simply because we are dealing with the submicroscopic domain, where much of our classical intuition regarding the behaviour of objects fails us. The lecture is a basic introduction to very interesting regions of subatomic physics.			
02ZJFB	Nuclear Physics B	KZ	3
This scientific field presents formidable challenges both experimentally and theoretically, simply because we are dealing with the submicroscopic domain, where much of our classical intuition regarding the behaviour of objects fails us. The lecture is a basic introduction to very interesting regions of subatomic physics.			
02ZSM	Introduction to the Standard Model	ZK	2
Particles, leptons, hadrons, baryons, mesons, symmetry, symmetry group, quarks, gluons, partons, standard model of electroweak and strong interactions, quantum chromodynamics (QCD), cross section, scattering cross section.			

04ABZK	English - State Examination	ZK	5
The course content is the examination as given by the study plan. Student is eligible for the State language examination (level C1 or B2 of CEFR) only if he/she has passed all the respective courses and examinations (04AP3KK, 04APAK, 04API, and 04APRK). From its first semester, part of the APIN programme covers also examination subjects. As required, examination conditions comply with respective rules and regulations for state language examinations.			
04AKS	English Conversation	Z	1
The course will develop the student´s communication skills acquired throughout their previous studies. It aims to improve all aspects of oral communication. The student will develop their vocabulary for various communication situations and will master their communication strategy. They will also practise their listening skills in order to better follow and participate in discussions. The student will be trained to express their ideas clearly and according to current English usage, and become a more confident speaker.			
04AM1	English for Intermediate Students M1	Z	1
The course is designed for students who have successfully completed the full secondary school English language course at least at the A2 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.			
04AM2	English for Intermediate Students M2	Z	1
The 04AM2 course expects the student to have completed the 04AM1 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.			
04AM3	English for Intermediate Students M3	Z	1
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.			
04AMZK	English for Intermediate Students Examination	ZK	4
The course content is the examination as given by the study plan. The examination covers the 04AM1, 04AM2, and 04AM3 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.			
04AP1	English for Advanced Students P1	Z	1
The course is designed for students who have successfully completed the full secondary school English language course (at least 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), i.e., into the fundamentals of vocabulary, functions, grammar, and style typical of professional oral and written communication situations (fundamentals of terms in mathematics and physics, definitions, graph descriptions, etc). It also covers professional oral and written communication on topics related to the undergraduate´s life and needs. It develops skills for free professional writing (writing a CV, letter of application, polite request). If necessary, revision of selected grammar topics is included.			
04AP2	English for Advanced Students P2	Z	1
The 04AP2 course is based on 04AP1, thus extending the student´s skills for working with subtechnical texts, and even with professional texts of chosen branches of science. According to the students´ needs it concentrates on chosen grammar topics, but mainly intends to develop understanding of syntactic structures and typical rhetorical functions (e.g., various types of descriptions, and, if possible, a case study). Increasing emphasis is placed on the undergraduate´s independent work with and reading of linguistically more demanding materials. The course extends the student´s subtechnical vocabulary, and includes fundamental notions of chosen branches of science. It is focused on formal writing including the sentence and paragraph structure, linking, cohesion and coherence in texts.			
04AP3	English for Advanced Students P3	Z	1
The 04AP3 course is based on 04AP2 and expects the student to work without any guidance with authentic professional materials and to interpret the text. It includes training oral and written communication skills and functions (e.g., expressing an opinion, agreement, and objections; taking part in discussion, note-taking; summarizing, writing an abstract) and, if possible, also preparing a project on a given or chosen topic and presenting it. The course places emphasis on distinguishing levels of formal and informal language both in oral and written communication.			
04APZK	English for Advanced Students Examination	ZK	5
The course content is the examination as given by the study plan. The student is supposed to demonstrate mastering the 04AP3 syllabus and the ability to apply their knowledge obtained in the three 04AP courses. The examination consists of 2 parts - written (110 min) and oral (30 min) and includes also oral presentation of a topic from the student´s field of study.			
04CESM1	Czech for foreigners - Intermediate	Z	1
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.			
04CESM2	Intermediate Czech 2	Z	1
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.			
04CESM3	Intermediate Czech 3	Z	1
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.			
04CESMZK	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 04CESM1,2,3 courses and can only be taken after successful completion of the 3 courses. Detailed information is to be obtained from the teacher.			
04CESP1	Czech for Foreign Students - Advanced Examination	Z	1
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.			
04CESP2	Czech for Foreigners - Advanced	Z	1
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.			
04CESP3	Czech for Foreigners - Advanced	Z	1
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.			
04CESPZK	Czech for Foreign Students - Advanced Examination	ZK	5
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 04CESP1,2,3 courses and can only be taken after successful completion of the 3 courses. Detailed information is to be obtained from the teacher.			

04FM1	French for Intermediate Students M1	Z	1
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. 04FM1 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.			
04FM2	French for Intermediate Students M2	Z	1
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.			
04FM3	French for Intermediate Students M3	Z	1
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.			
04FMZK	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.			
04FP1	French for Advanced Students P1	Z	1
04FP 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. 04FP1 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.			
04FP2	French for Advanced Students P2	Z	1
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).			
04FP3	French for Advanded Students P3	Z	1
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.			
04FPZK	French for Intermediate Students Examination	ZK	5
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.			
04FZ1	French for Beginners Z1	Z	1
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. 04FZ1 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.			
04FZ2	French for Beginners Z2	Z	1
The course is linking up with 04FZ1. 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.			
04FZ3	French for Beginners Z3	Z	1
The course builts upon 04FZ2. 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.			
04FZ4	French for Beginners Z4	Z	1
The course builds up on 04FZ3. 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.			
04FZ5	French for Beginners Z5	Z	1
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.			
04FZZK	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.			
04NM1	German for Intermediate Students M1	Z	1
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.			
04NM2	German for Intermediate Students M2	Z	1
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).

04NM3	German for Intermediate Students M2	Z	1

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).

04NMZK	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 04NM1 - 04NM3. 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.

04NP1	German for Advanced Students P1	Z	1

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.

04NP2	German for Advanced Students P2	Z	1

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).

04NP3	German for Advanced Students P3	Z	1

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.

04NPZK	German for Advanced Students Examination	ZK	5

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 04NM1 - 04NM3. 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.

04RM1	Russian for Intermediate Students M1	Z	1

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.

04RM2	Russian for Intermediate Students M2	Z	1

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.

04RM3	Russian for Intermediate Students M3	Z	1

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.

04RMZK	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.

04RP1	Russian for Advanced Students P1	Z	1

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.

04RP2	Russian for Advanced Students P2	Z	1

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.

04RP3	Russian for Advanced Students P3	Z	1

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.

04RPZK	Russian for Intermediate Students Examination	ZK	5

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.

04RZ1	Russian for Beginners Z1	Z	1

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.

04RZ2	Russian for Beginners Z2	Z	1

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.

04RZ3	Russian for Beginners Z3	Z	1

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.

04RZ4	Russian for Beginners Z4	Z	1
The course is based on 04RZ3. 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.			
04RZ5	Russian for Beginners Z5	Z	1
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.)			
04RZZK	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.			
04SM1	Spanish for Intermediate Students M1	Z	1
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 (e.g., 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 everyday or easy subtechnical topic, for which the students are trained by reading texts or listening to them.			
04SM2	Spanish for Intermediate Students M3	Z	1
The course develops the students´ knowledge from the previous course (SM1). Students are gradually acquainted with fundamentals of Spanish for specific purposes in order to be able to work with specialized texts on the Internet.			
04SM3	Spanish for Intermediate Students M3	Z	1
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.			
04SMZK	Spanish for Intermediate Students Examination	ZK	4
The course content is the examination as given by the study plan. 04SMZK examination consists of two parts - written and oral; to be eligible for the written part, students will have obtained non-graded assessment for course 04SM3.Oral examination follows the written part.			
04SP1	Spanish for Advanced Students P1	Z	1
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.			
04SP2	Spanish for Advanced Students P2	Z	1
Course SP2 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.			
04SP3	Spanish for Advanced Students P3	Z	1
Course 04SP3 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.			
04SPZK	Spanish for Advanced Students Examination	ZK	5
The course content is the examination as given by the study plan. Examination 04SPZK 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 SP1, SP2, and SP3 or on an individual study plan of the student.			
04SZ1	Spanish for Beginners Z1	Z	1
Course 04SZ1 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.			
04SZ2	Spanish for Beginners Students Z2	Z	1
Course 04SZ2 is based on course 04SZ1, 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.			
04SZ3	Spanish for Beginners Z3	Z	1
The course is based on course SZ2, and develops the student´s vocabulary and grammar structure. The course covers realia (history and culture) of the Spanish-speaking countries, mainly of Spain. It pays attention to further grammar topics (pretérito perfecto, pretérito indefinido, pretérito imperfecto, the gerund and the imperative). It includes written and oral communication on a given general topic, for which the student is trained by reading texts or listening to them.			
04SZ4	Spanish for Beginners Z3	Z	1
The course is based on course SZ3. 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.			
04SZ5	Spanish for Beginners Z5	Z	1
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 presentations and, finally, a written and oral examination.			
04SZZK	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. Student can register for oral examination only if he/she has passed the written examination test.			
11ANEL	Linear Circuit Analysis	Z,ZK	4
The course is the introduction to the linear electronics for physicists. In the first part it describes basic methods of linear circuit analysis. It is especially oriented to the understanding of the computer methods of analysis. The second part gives a short list of most commonly used circuits in experimental equipment.			
11APLG	Applications of Group Theory in Solid State Physics	ZK	2
Consideration of atomic system symmetry allows, without any quantitative calculations, rigorously and precisely determine how many energy states there are and what interactions and transitions between them may occur. Therefore, the main purpose of this course is to describe the methods by which we can extract the information on the object that symmetry alone will provide. The application of these methods is illustrated by an example of molecular orbitals, inner orbitals of ions in the crystal field environment, normal modes of molecular vibrations, and selection rules for optical absorption transitions.			
11ELEA	Instrumentation and Measurement	Z,ZK	2
The course is the introduction to the instrumentation and measurement for physicists.			

11MIK	Logical Circuits and Microprocessors	Z,ZK	4
The course is the introduction to the digital electronics for physicists. It describes the function principles of combination circuits, simple sequential circuits and complex circuits like microprocessors. The microcomputer architecture and principles of interfacing is shown.			
11SFBM	Structure and Function of Biomolecules	Z,ZK	3
Knowledge of macromolecular structure is crucial for the understanding of its function. The subject is focused on the introduction to building blocks of macromolecules, overall structure and its structure:function relationship including macromolecular complexes.			
11UFPLN	Introduction to Solid State Physics	ZK	2
The purpose of this lecture is to introduce the undergraduate students to the study of the solid state physics.			
11UVOD	Introduction to Specialization	Z	2
The purpose of this lecture is to introduce the undergraduate students to the physical master degree study programmes.			
11ZFPL	Basic to Solid State Physics	KZ	2
The purpose of this lecture is to introduce the undergraduate students to the study of the physical properties of solid state.			
12APL	Application of Lasers	Z,ZK	2
Application of lasers in industrial technologies, medicine, remote sensing, energetics, telecommunication, military, entertainment and other branches.			
12AUX	Administration of UNIX System	KZ	2
Basic and more advanced administration of Unix operating system			
12BFY3	Physics 3	Z,ZK	4
Částicové vlastnosti vln. Vlnové vlastnosti částic. Struktura atomu. Bohrův model atomu. Schrödingerova rovnice. Základní řešení Schrödingerovy rovnice. Kvantová teorie atomu vodíku. Víceelektronové atomy. Atomová spektra. Chemická vazba. Struktura molekul. Molekulová spektra.			
12BFY4	Physics 4	Z,ZK	4
Introduction to Thermodynamics, Statistical physics, Solid state physics fundamentals, Plasma physics fundamentals.			
12BPLA1	Bachelor Thesis 1	Z	5
The course concerns the topic, given by the bachelor work supervisor. The successful defense of the bachelor thesis is the integral part of the particular bachelor curriculum, depending on the specialization. The bachelor work submission is agreed upon by the departmental head and the faculty dean. A student pursues the background research, based on journal, internet as well as special book literature, given by the bachelor work advisor, included in the official bachelor work submission, and further independently searched out by the student. With a supervisor agreement, the student further solves given particular problems, based on the studied and recommended literature sources. The thesis is reviewed by one (typically internal) reviewer who is an expert in the field. Contact hours represent individual communications with the bachelor work advisor where current needs are discussed and solved. The course is thus not regularly scheduled.			
12BPLA2	Bachelor Thesis 2	Z	10
The course concerns the topic, given by the bachelor work supervisor. The successful defense of the bachelor thesis is the integral part of the particular bachelor curriculum, depending on the specialization. The bachelor work submission is agreed upon by the departmental head and the faculty dean. A student pursues the background research, based on journal, internet as well as special book literature, given by the bachelor work advisor, included in the official bachelor work submission, and further independently searched out by the student. With a supervisor agreement, the student further solves given particular problems, based on the studied and recommended literature sources. The thesis is reviewed by one (typically internal) reviewer who is an expert in the field. Contact hours represent individual communications with the bachelor work advisor where current needs are discussed and solved. The course is thus not regularly scheduled.			
12EGS1	English Graduate Standard 1	KZ	4
Improving the knowledge in English, English Presentation, English Discussions, creation of the technical text, structures of important documents, Proceedings to be published			
12EPR1	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	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.			
12INF0	Informatics 0	KZ	2
Vector graphics basics, scientific plots, dala visualization basics, measurements results presentation			
12INS1	Information Systems 1	Z,ZK	2
Information technology, architecture of the databases, network databases, cloud application Google, Microsoft, information managament, aproaches to solve task of information systems			
12INS2	Information Systems 2	Z,ZK	2
Graduation of Information systems 1 is required. In more details: Information technology, architecture of the databases, network databases, cloud application Google, Microsoft, information managament, aproaches to solve task of information systems			
12IPG	Internet and Computer Literacy	Z	2
The repetitorium of principles of computer networks. Introduction to CTU network specifics, Czech computer-focus law. Poster as a tool for knowledge presentation.			
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.			
12LT1	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.			
12LT2	Laser Technique 2	Z,ZK	2
Laser oscillator, the rate equation, the laser amplifier, Q-switching, mode-locking			
12MOF	Molecular Physics	ZK	2
Basic ideas on multi-atomic molecules and molecular matter, and on structure-to-physical properties relations. 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 1	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			

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.			
12NME1	Numerical Methods 1	Z,ZK	4
There are explained 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 principle programming language as a demonstration tool. The seminars are held in computer laboratory.			
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.			
12OPEL	Optoelectronics	Z,ZK	2
Physics and technology of optical fibre and p[lanar waveguides, fibre amplifiers and lasers. Photonic integration. Photonic crystals and plasmonics. Applications in optical communication and sensors.			
12OPK	Optics Communications	ZK	2
Basics on signal transmission over optical fibres in communication networks. Sources and detectors of infrared radiation for optical communication. Transmission properties of optical fibres. Single channel optical fibre links. Signal multiplexing. Multiple channel optical fibre links. Coherent optical communication. Optical signal switching. Optical fibre networks. Services in electronic communication networks. Trends in development of information systems using optical fibre networks for signal transmission.			
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.			
12PDR1	Data Communication and Interfaces 1	Z	2
Principles of computer networks, networks architectures and data transfer. Specification of existing network architectures.			
12PDR2	Data Communication and Interfaces 2	Z	2
Principles of Ethernet standards and basics of protocol suite TCP/IP.			
12PEL1	Practical Electronics 1	Z,ZK	2
Recapitulation of basics electronic, mathematical analyses of circuit solving. Measurement in electronic, measurement of frequency and phase. Analogue to digital converters and digital signal processing. Function of voltmeter, ampermeter, oscilloscope, spectral analyser and logical analyser.			
12PEL2	Practical Electronics 2	Z,ZK	2
Noise analyses in electronics, low noise electronics system design. Noise measurement. Time measurement. Printed circuit design.			
12PIN1	Practical Informatics for Technics 1	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. Requirements on operating system for research and technical computing. Operating system UNIX. Basic principles, kernel, kernel services. Documentation. File system, file atributes, working with files. Text editors: vi, emacs. Command interpreter (shell) sh, csh and its programming (scripts). Controlling processes, process status, computer load a process priorities. Standard tools. Graphical user interface X-windows. Computer networks. Local computer networks. Global computer networks: Internet. Addresses and protocols TCP/IP. Network configutation of a computer. Network services: hardware sharing, mail, ftp, etc. Network applications			
12PIN2	Practical Informatics for Technics 2	Z	2
Practically oriented three semester course of basics and applications of informatics for science and engineering included as obligatory alternative course. Constituent part is realized in computer classrooms. The second part of the course is "Introduction to computer algebra systems?.			
12PIN3	Practical Informatics for Technics 3	Z	2
Practically oriented three semester course of basics and applications of informatics for science and engineering included as obligatory alternative course. Constituent part is realized in computer classrooms. The third part of the course is "Introduction to scientific computing?.			
12POAL	Computer Algebra	KZ	2
Lisp, representation of basic objects (integers, rational and algebraic numbers, polynomials, rational functions, radicals, algebraic functions), arithmetics, simplification, greatest common divisor, resultant, derivation, series summation, integration, ordinary differential equations, factorization, equations solving, quantifier elimination, substitution and pattern matching, algebraic programming, graphics, Maple - detailed introduction and solving of practical examples, applications, overview of other systems (Axiom, Macsyma, Mathematica), miniproject.			
12PSEM	Problem Seminary	Z	2
25 seminaries with topics from the region of solid materials engineering, physical electronics, materials science, nuclear reactors, dosimetry and application of ionizating radiation.			
12PYTH	Scientific Programming in Python	Z	2
The aim of this course is to learn the fundamentals of the modern Python programming language with a focus on scientific computing. Emphasis is placed on effective solutions to real problems. The course is performed in an interactive form of practical exercises, whose topics can be tailored to the content of other subjects or student theses. Students are also involved in ongoing research. In the introductory part of the course, students learn the basic features of Python?from basic types to object oriented or functional programming. The greater part of the course focuses on specific features of Python for scientific programming. Presented are the main numerical libraries NumPy, SciPy and the Matplotlib graphics library. We show how to generate efficient code, how to combine Python with other languages, what tools are available.			
12ROPR1	Annual Project 1	Z	4
Individual work on solving of a problem. In the winter semester, it has character of a background research, in the summer semester, student's own contribution to the problem solution is expected. Basics of independent work on the problem solution, public presentation of the progress of the solution, presentation in a foreign language, protocol elaboration, work with literature, references and citations.			
12ROPR2	Annual Project 2	Z	8
Individual work on solving of a problem. In the winter semester, it has character of a background research, in the summer semester, student's own contribution to the problem solution is expected. Basics of independent work on the problem solution, public presentation of the progress of the solution, presentation in a foreign language, protocol elaboration, work with literature, references and citations.			
12RSEN	Control Systems and Sensors	Z,ZK	4
The lecture addresses the theory, analysis and implementation of linear analog and digital control systems and sensors for several physical quantities. The part of the lecture is devoted to computer modeling and simulation using MATLAB and practical measurements on a continuous system with analog control (servomechanism with electrical motor) or continuous system with discrete control (temperature control using thermoelectric cooler module) performed by the students.			

12SBA1	Bachelor Seminar 1	Z	1
	Literature overview, Theoretical Background and practical work, Project presentation.		
12SBA2	Bachelor Seminar 2	Z	2
	Literature overview, Theoretical background and practical work, Project presentation, Defence preparation		
12TAIS	Ion Beam Techniques and Applications.	ZK	3
	Production and forming of ion beam, charged particle optics, interaction of ion with solid matter, technological and analytical applications.		
12ULT	Introduction to Laser Technique	Z,ZK	3
	Overview of electromagnetic radiation sources; laser principle; classification of lasers; characterization and rough application of various types of lasers; laser safety precautions.		
12UMF	Introduction to Modern Physics	Z	3
	The course is intended to be a concise introduction to modern / nonclassical physics for students who have already had basic classical physics course. A part of the course is delivered in a computational laboratory.		
12VAK	Vacuum Physics and Technology	KZ	4
	Rarefied gasses: basic concepts and relations; flow of rarefied gas. Interaction of gas with surface of solid surface; sorption, desorption; evaporation, condensation; gas transport through solid matter; Vacuum generation. Pumping process. Pumps.Vacuum measurements: vacuum gauges of total and partial pressure; pumping speed; gas flow, conductivity, searching for leaks. Materials and vacuum instalation parts. Practical exercises.		
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.		
12ZAOF	Fundamentals of Optical Physics	Z,ZK	4
	The lecture covers the very basics of optics. Namely, electromagnetic theory, linear optical physics and material effects, basics of nonlinear approach, and geometrical optics. The main goal of the lecture is to provide broad and general information on optics for the bachelor level students. The scope of the lecture gives 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 also 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 graphical form, including fundamentals of grating diffraction. Based on this diffraction principle, basic principles of holography are clarified. Finally, the lecture unravels the geometrical optics limit. It takes notice on geometrical approach imaging, substitutive scheme of a paraxial imaging system, and optical aberrations. It shows fundamentals of imaging in optical instruments.		
12ZAOP	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.		
12ZDP	Data Processing for Publishing	Z	2
	Typography, computer computer-assisted publishing, coding of text, OCR (optical code recognition), DTP (desk top publishing), programming languages for typesetting (TeX, LaTeX, HTML, XML,..., publishing into www pages, cloud computing,commonly used graphical formats, formatting of typical data (PDF, PS, DOC, DOCX, PPS, PPSX, RFT, XLS, XLSX), multimedial presentations, multimedial formats.		
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.		
12ZELD	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.		
12ZFP	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. Fokker-Planck collision term is derived. Basics of atomic physics od multiply-ionized plasmas are introduced.		
12ZMD	Measurement and Data Processing	KZ	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.		
12ZPLT	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.		
12ZPOP	Basic Optical Laboratory	KZ	6
	The practical laboratories give advanced practical skills by experimental work in optics and optoelectronics. Laboratory records must be elaborated.		
14ELMI	Electron Microscopy	Z,ZK	3
	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.		

14TEM	Engineering Mechanics	Z,ZK	6
Abstract: The course represents a link-up between the theoretical mechanics of rigid bodies and engineering disciplines dealing with stress and strain analysis of real structure parts (elasticity, plasticity, fracture mechanics, etc.). Principles of statics, kinematics, and dynamics and their application.			
14TM	Engineering Mechanics	Z,ZK	4
The course represents a link-up between the theoretical mechanics of rigid bodies and engineering disciplines dealing with the stress and strain analysis of real structure parts.			
14ZZKS	Testing and Processing of Metals and Alloys	KZ	4
Abstract: Tension tests, hardness, impact toughness, technological testing, fatigue testing, creep testing. Light microscopy, preparation of specimens for macro- and micro-observation. Casting, forming, welding, soldering, brazing, powder metallurgy, mechanical machining. Copper alloys, aluminium alloys, titanium alloys, special alloys of non-ferrous metals. Technical drawing and CAD.			
15CH1	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 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.			
15CHEM	Analytical Calculations and Chemometry Principals	ZK	2
Lecture deals with basic principles of chemometry including errors in classical and instrumental analysis, probability theory, propagation of errors, basic data distributions, one- and two-tailed significance testing, hypothesis testing, least squares regression and correlation, calibration and fitting methods, non-parametric testing, seminar part consists of equation solving, titration stoichiometry of redox, acid-base, complex and precipitation reactions, gravimetric stoichiometry. pH calculations, calculations in potentiometry, coulometry, spectrophotometry and separation methods, solving of complex forming equilibria.			
15DALCH	History of Alchemy and Chemistry	ZK	2
This course provides the overview of crafts with chemical and/or metallurgical basis. Development of alchemy from ancient times in China, India, and Hellenistic world is discussed. The last part of course is dedicated to Alchemy in Arabic world and various aspects of alchemy in Latin Europe. The influence of alchemical approaches development onto crafts advancement is illustrated.			
15INPR	Laboratory Practice in Instrumental Methods	KZ	4
Practical training of students in the use of selected modern instrumental methods and techniques for solving some physico-chemical analytical and others problems. The training is carried out in the laboratories of Czech Academy of Sciences (Institute of Physical Chemistry) and partly in laboratory at the Department of Nuclear Chemistry.			
15ZKJE	Nuclear Power Plants Design and Operation	ZK	3
Target of lecture is to create basic knowledge of physics of nuclear reactors utilizing fission. Further explains arrangement of nuclear fuel, purpose, technological and material construction of core. Function and construction of all components are defined wit regard to nuclear physics, physics of shielding, theory of regulation, material science, chemistry, heat transfer and dosimetry. Creates knowledge for evaluation of nuclear safety and radiation protection in nuclear energy, reliability and economy for comparison with other sources of energy, to environment and to strategic importancy of nuclear sources of energy. Gives basic knowledge of construction, operation and decommissioning of nuclear power stations. Informs about high level nuclear waste and spent fuel and their management.			
16AMMB	Fundamentals of Analytical Measurement Methods	ZK	2
Basic principles, technical performance and utilization of methods of chemical analysis. Basic methodology of analytical determination, gravimetry, titration methods, potentiometry, polarography, refractometry, polarimetry, UV-VIS spectroscopy, atomic emission and absorption spectroscopy, infrared and Raman spectroscopy, X-ray structural analysis, nuclear magnetic and electron spin resonance, mass spectrometry, thermometric methods, gas and liquid chromatography.			
16APLB	Application of Ionizing Radiation in Analytical Methods	ZK	5
Subject The application of ionizing radiation in analytical methods is devoted to radioanalytical methods and the use of radionuclides and ionizing radiation in the analysis and diagnosis of technological processes.			
16EPAM	Exact Methods in Research of Historic Monuments	ZK	2
Aims and methods of historic monument investigations, methods of age determination (radiocarbon, thermoluminescence and related methods, further radiation methods, dendrochronology, archaeomagnetism), analytical methods for determination of origin and production technologies of artefacts (activation analysis, X-ray fluorescence analysis and other methods), photogrammetry.			
16FNZB	Problems of Non-ionizing Radiation	ZK	2
Subject is focused on biological effects of non-ionizing radiation and its use in physical praxis. Information about principles, biological effects and methods used in fields of magnetic resonance and ultrasound as applied in various types of technical or medical equipment are given as well.			
16KPR	Clinical Propaedeutic	ZK	2
Making students familiar with the basics of anamnesis, physical examination, examinational methods of different organs, hematological and biochemical examinations and anaesthesia			
16MCRB	Transport of Ionizing Radiation and Monte Carlo Method	Z,ZK	4
Introduction to principles of Monte Carlo method and its use for radiation transport simulation, selected concepts of probability theory and mathematical statistics. Physical models of interaction of different types of radiation and their use for stochastic modeling of their substance transport. Model description concepts, geometric model layout, source term, scoring methods, and modeling of measured variables and parameters. Statistical evaluation of reliability of modeling results, variance reduction methods, program codes and tools for radiation transport modeling, MCNP program, its possibilities and use. Procedures for the practical use of the program for typical tasks in the field of dosimetry, application of ionizing radiation, detection and detection systems, radiation protection and medical applications.			
16MEZB	Fundamentals of Ionizing-Radiation Metrology	Z,ZK	4
The course summarizes the basic objectives and content of ionizing radiation metrology. It deals with the interpretation of radiation quantities and units in metrology. It summarizes the theoretical and experimental foundations of metrology, the determination of basic parameters of radiation. Lectures are supplemented with basic summary of relevant legislation and regulations.			
16SED1	Dosimetry Seminar 1	Z	2
The seminary is supposed to motivate the student´s interest in the field of dosimetry. Since the students are usually not familiar with dosimetry, the seminary provides a review of possible fields of study and employment. First two lectures focus on the basics of radiation physics. The following lectures are given by the former students of DDAIR, who are currently employed in various organizations (SÚRO, v.v.i., ÚJF AV ČR v.v.i., ÚJV Řež, ČMI, Hospital Na Homolce, FN v Motole, PTC Czech s.r.o., CERN, Fermilab).			
16SED2	Dosimetry Seminar 2	Z	2
Dosimetry Seminary 2 follows-up SED1. In this seminary students will listen to the lectures of the older students of DDAIR. The older students give lectures about their progress on the research topic of their theses. The course also introduces the principles of creating good presentation and advice for working with scientific literature.			
16UAZB	Principles of Ionizing-Radiation Applications	ZK	2
Historical outline of applications, review of interaction of radiation with a matter, radiation sources, detectors and instrumentation, evaluation of radionuclide measurements, use of penetration and scattering of radiation beams, selected radioanalytical methods, tracer methods, radionuclide dating, further possibilities for the use of ionizing radiation.			

16ZBAF1	Fundamentals of Human Biology, Anatomy and Physiology 1	Z,ZK	4
Organization of living systems, non-cellular and cellular organisms, prokaryotic and eukaryotic cell. Molecular and cell biology. Biopolymers. Molecular genetics. Cell cycle, mitosis, their regulation. General human anatomy. Basics of medical terminology. Overview of tissues. Skeleton. Muscle anatomy in general. Digestive system and its physiology. Respiratory system and physiology of respiration. Excretory and genital tract.			
16ZBAF2	Fundamentals of Human Biology, Anatomy and Physiology 2	Z,ZK	4
Heart and physiology of cardiac activity. General anatomy of blood vessels, main arteries of the body, overview of veins and physiology of blood, blood clotting. Overview of nerves. CNS. Visual system and physiology of the visual system. Auditory and vestibular system and physiology of hearing and balance. Skin, endocrine glands.			
16ZDOZ1	Fundamentals of Radiation Dosimetry 1	Z,ZK	4
History, development, and objectives of dosimetry. Quantities and units used for description of sources, fields, interactions of ionizing radiation, ionizations, energy transfer and absorption. Fundamentals of the effects of ionizing radiation.			
16ZDOZ2	Fundamentals of Radiation Dosimetry 2	ZK	2
Fundamentals of biological effects of ionizing radiation. Quantities and units used in radiation protection. Recommendations of ICRP and ICRU. Principles and methods of measurements in dosimetry. Determination of activity and neutron source emission. Measurements of absorbed dose and exposure.			
16ZEDB	Basics of Experimantal Data Processing	ZK	2
Statistical analysis of experimental data; univariate data; calibration; regression; multivariate data.			
16ZIVB	Introduction to Ecology	KZ	2
The subject inform about basic of the ecologic principles, terms and ideas. It covers overview information regarding to particular components of the environment and evaluate economic indicators and sustainable development.			
16ZJTB	Nuclear Energy Facilities and Accelerators	ZK	2
Basic scheme of nuclear reactor and nuclear power plant, chain fission reaction development, main components of nuclear energetic reactor, most important reactor types, linear high-voltage accelerators, linear high-frequency accelerators, accelerators based on cyclotron, microtron, betatron, electron and proton synchrotrons, electron and ion sources for accelerators, targets.			
16ZPSP	Basic Work with PC	Z	2
The aim of the subject is to teach basic skills associated with a personal computer. The introductory part of the course is devoted to information systems and resources available to the CTU and PNSPE students. Another part summarizes basic information about computer hardware, software and security. Most of the course is devoted to exercises whose aim is to teach students to use office software (word processor, spreadsheet, presentation software) at a level that is required in other courses of study (practice, undergraduate thesis, research and thesis).			
16ZRAO	Basics of Radiation Protection	Z	2
The aim of the course is to familiarize students with the general principles of radiation protection. The main emphasis is put on basic mechanisms and concepts, in order to allow critical orientation in this field. The course provides answers to the cardinal questions: What is ionizing radiation (IR), where it comes from, whether and how it is dangerous for people, what is the meaning of protective units (Gray, Sievert), how to prevent malicious effect of IR and many others. The content of the lectures does not require any prior knowledge.			
17ENF	Experimental Neutron Physics	KZ	2
The lectures are mainly focused on detailed characterisation of neutron properties, characteristics of neutron (reactor and non reactor) sources, properties of prompt and delayed neutrons, neutron detection methods, neutron induced nuclear reactions, modification and adjustment of neutron field, science and industry neutron applications. Last lecture deals with experimental data processing and analysis. The lectures are supplemented with experimental practices in the field of neutron detection, determination of delayed neutron properties, study of neutron diffusion in various materials, preparation and characterisation of photo-neutron source and neutron source calibration. Experimental practices will be running at training reactor VR-1 and in the neutron laboratory.			
17JARE	Nuclear Reactors	ZK	2
Introduction. World power issue. Previous evolution of power reactor. Nuclear fission reactors, fuel assemblies, active core, control systems, safety systems, containment. Classification of reactors into IV generations. Standard types of nuclear power reactors: concept, description, layout, previous evolution, world share, perspectives. Pressurized water reactors (PWR). Western-type PWR (Westinghouse, KWU, Framatom). VVER-type reactors , Temelín nuclear power plant. Boiling water reactors. Heavy water reactors, fast breeder reactors, high-temperature gas cooled reactors. Second nuclear era. reactors of generation III (EPR, AP-1000, VVER 1200). Reactors of generation IV: GIF and INPRO initiatives. Evaluation and selection of proposed systems. Six selected concepts. ICRP scenarios of word evolution, hydrogen power, role of nuclear power in long-term outlook			
17UINZ	Introduction to Engineering	Z,ZK	3
The course is devoted to an introduction to the engineering profession. Students will gradually learn the characteristics and specialties of engineering work, including an overview of the basics of selected engineering disciplines, such as the basics of materials science, manufacturing technology, quality control and assurance and ecology. Further, the course will focus on some issues of R&D activities organization and on selected parts of technical drawings and the work with AutoCAD code.			
17VYR	Research Reactors	ZK	2
Course is devoted to research reactors and their applications for the need of research and industry. Students get familiar with research reactor types and their experimental programme along with experimental equipment needed for particular applications and their specifics. The course is supported by technical visit to research reactor workplace.			
17ZEH	Basics of Economic Assessment	ZK	2
The course focuses on the economic evaluation of Nuclear power plants. Introductory lectures are concerned with an introduction to economy and the basic component parts of microeconomics. Lectures continued with insight into the business and managerial economics, explanation of the concepts of incomes, expenses, etc. and their applications in electrical energy resources evaluation. Second part of lectures is focused on evaluation of nuclear power plants - the fuel cycle and operations of NPP.			
17ZEL	Basics of Electronics	KZ	3
Lectures provide basic information of electronics. In the beginning, lectures are devoted to passive components - resistors, capacitors, inductors and solution of electrical circuits with them. Next, lectures deal with semiconductor components (standard, Zener, capacitive, LED), bipolar, unipolar transistors and semiconductor components with more layers (thyristors and triacs). Lectures continue with general amplifiers and operational amplifiers. Finally, lectures deal with digital circuits, digital/analog and analog/digital converters. Lectures are completed with electronic laboratory exercises.			
18EKO1	Mathematical Economics 1	Z,ZK	5
The course introduces selected models and methods for economic decision making. The main attention is given to optimization models of linear programming, possibilities of their real applications and their solving by means of the current software products.			
18EKO2	Mathematical Economics 2	Z,ZK	5
The course introduces selected models and methods for economic decision making. The main attention is given to optimization models in graphs, project management, inventory management with deterministic and stochastic demand, queuing theory and simulation models.			
18ESPG1	European Computer Driving Licence 1	Z	2
Spreadsheet calculators are an important tool, especially for students and graduates in Software engineering in economics. The winter semester introduces the students also into other office tools. The accent is put on advanced functions of MS Excel (names, functions and expressions, pivot table and graph). Next, the VBA language will be introduced and macros and user functions will be addressed.			

18ESPG2	European Computer Driving Licence 2	Z	2
Spreadsheet calculators are an important tool, especially for students and graduates in Software engineering in economics. Summer semester follows the winter semester with advanced VBA programming topics (charts, objects, graphical user interface, add-ins programming) and introduces some applications in economics, mathematics, operational research, and computer science.			
18INTA	Generation of Internet Applications	KZ	4
WWW principles (HTTP, URL, client-server, HTML, CSS), fundamentals of WWW pages generation, server technologies for internet applications, PHP - hypertext preprocessor: syntax, variables, statements, user functions, arrays, regular expressions, working with files, working with database, working with objects, working with images, e-mail, security, examples of internet applications.			
18MAK1	Macroeconomics 1	Z,ZK	4
Macroeconomics I provides students with a fundamental theoretical basis for understanding how an economy works. It introduces main macroeconomic indicators, money market, macroeconomic equilibrium theory, fundamentals of open economy theory, inflation, unemployment, economic growth, economic fluctuations, basic macroeconomic models of IS-LM, AS-AD and their implications for economic policies. The learning outcomes of the course is to equip students with ability to analyze macroeconomic phenomena and their interconnections and subsequently to use them under the conditions of modern economic life.			
18MAK2	Macroeconomics 2	Z,ZK	4
Macroeconomics II extends theoretical knowledge acquired from Macroeconomics I of its students with the latest knowledge of contemporary macroeconomics. They are models of economic growth, especially those with an emphasis on the role of human capital and technological progress. Furthermore, it introduces students to modern principles of economic modeling, i.e., macroeconomic models derived from microeconomic behavior of subjects and economics and their rational expectations. It also provides students with modern knowledge of labor market modeling.			
18MIK1	Microeconomics 1	Z,ZK	5
Microeconomics is a set of theories, which help us to understand processes by which the scarce resources are allocated among alternative uses. Microeconomics explains the role of prices and markets in these processes, and makes more clear behaviour of the economic agents. This course of Microeconomics I consist of introduction in Microeconomics and Consumer Theory.			
18MIK2	Microeconomics 2	Z,ZK	5
Microeconomics is a set of theories, helping us to understand process by which scarce resources are allocated among alternative uses. Microeconomics explain the role of prices and markets in this process and make clear economic agents behaviour. The lectures of Microeconomics II are oriented on Theory of Firm and Industrial Organisation.			
18MPT	Programming in MATLAB	KZ	5
The subject acquaints students with various programming techniques in the Matlab environment. The emphasis is placed on the differences in programming methodology in Matlab compared to classical languages.			
18MTL	Programming in MATLAB	Z,ZK	5
Introducing Matlab environment as efficient tool for computation in complex arrays and symbolic variables, namely for linear algebra, mathematic analysis, statistics, algorithmization and geometric representation of results.			
18PAS	Pascal Programming	Z	4
This lecture 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 Pascal programming language.			
18PJ	Programming in Java	Z,ZK	5
This course is devoted to the Java platform and to the development of the basic types of applications for this platform.			
18PRC1	Programming in C++ 1	Z	4
This course covers mainly the C programming language and non-object oriented features of the C++ language.			
18PRC2	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.			
18UOA	Introduction into Object Oriented Architecture	Z,ZK	4
18ZALG	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.			
18ZPRO	Basics of Programming	Z	4
This lecture 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 C++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

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