Study plan

Name of study plan: Fyzika a technika termojaderné fúze

Faculty/Institute/Others:
Department: Department of Physics
Branch of study guaranteed by the department: Physics and Technology of Thermonuclear Fusion
Garantor of the study branch: prof. Ing. Igor Jex, DrSc.
Program of study: Applications of Natural Sciences
Type of study: Follow-up master full-time
Required credits: 91
Elective courses credits: 29
Sum of credits in the plan: 120
Note on the plan:

Name of the block: Compulsory courses of the specialization
Minimal number of credits of the block: 91
The role of the block: PO

Code of the group: NMSFTTFPP1
Name of the group: NMSFTTF - 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 13 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
02AMF	**Atomic and Molecular Physics** *David Břeň* ***Michal Špaček*** *David Břeň (Gar.)*	Z,ZK	4	2+2	Z	PO
02DPLA	**Plasma Diagnostics** *Pavel Kubeš Pavel Kubeš (Gar.)*	Z,ZK	3	2+1	L	PO
12FIF	**Inertial Fusion Physics** *Ondřej Klimo* ***Ondřej Klimo*** *Ondřej Klimo (Gar.)*	Z,ZK	4	3+1	Z	PO
02FT	**Physics of Tokamaks** *Jan Mlynář Jan Mlynář (Gar.)*	Z,ZK	4	3+1	Z	PO
14NMR	**Materials Science for Reactors** *Petr Haušild Petr Haušild (Gar.)*	ZK	2	2+0	6	PO
02PMPL	**Computer Modelling of Plasma** *Radek Plašil Radek Plašil (Gar.)*	Z,ZK	3	2+1	L	PO
02PRPL1	**Laboratory Work in Plasma Physics 1** ***Jana Brotánková*** *Vojtěch Svoboda (Gar.)*	Z	2	0+2	Z	PO
02PRPL2	**Laboratory Work in Plasma Physics 2** *Vojtěch Svoboda Vojtěch Svoboda (Gar.)*	KZ	2	0+2	L	PO
02TTJZ	**Technology of Thermonuclear Facilities** *Slavomír Entler Slavomír Entler (Gar.)*	ZK	3	3+0	L	PO
02TPLA1	**Plasma Theory 1** *Petr Kulhánek Petr Kulhánek (Gar.)*	Z,ZK	5	2+2	Z	PO
02TPLA2	**Plasma Theory 2** *Petr Kulhánek Petr Kulhánek (Gar.)*	Z,ZK	5	3+1	L	PO
02VUTF1	**Research Project 1** *Vojtěch Svoboda (Gar.)*	Z	6	6	Z,L	PO
02VUTF2	**Research Project 2** *Vojtěch Svoboda (Gar.)*	KZ	8	8	L,Z	PO

Characteristics of the courses of this group of Study Plan: Code=NMSFTTFPP1 Name=NMSFTTF - povinné předměty 1. ročník

02AMF	Atomic and Molecular Physics	Z,ZK	4
This lecture course provides a theoretical introduction to atomic and molecular physics.			
02DPLA	Plasma Diagnostics	Z,ZK	3
The goal of the lecture is to obtain the overview of measurements of basic parameters of hot plasma and their components - density, temperature, electromagnetic fields, radiation and energy and temporal and spatial distribution. The students will acquaint with principles, methodic, demonstration, examples and application of basic diagnostics.			

12FIF	Inertial Fusion Physics	Z,ZK	4
These lectures aim to introduce to the topic of inertial confinement fusion (ICF). Physical processes, which take place during the individual stages before and after ignition of the fuel are discussed. The problems (instabilities etc.), which make the inertial confinement and the ignition of the fuel more demanding are discussed and their potential solutions are presented. New projects in the field of ICF including some preliminary reactor designes are reviewed.			
02FT	Physics of Tokamaks	Z,ZK	4
Students will be introduced in detail to physics of tokamak experiments. The course will be focused on the physics context, terminology and phenomenology of the subject so that the participants can substantially improve their capacity to search for information and to work independently with scientific literature.			
14NMR	Materials Science for Reactors	ZK	2
Materials for classical and fusion reactors			
02PMPL	Computer Modelling of Plasma	Z,ZK	3
The goal of the lecture is to acquaint the students with basic methods of computer modelling in physics and to apply these techniques to the study of physical processes in both low-temperature and high-temperature plasmas.			
02PRPL1	Laboratory Work in Plasma Physics 1	Z	2
The main aim of the course Laboratory Work in Plasma Physics is to get students acquainted with several complex experimental devices (tokamaks GOLEM and COMPASS, large laser facility PALS, experimental fission reactor VR-1 VRABEC and others). Besides that, students obtain and strengthen basic skills critical to their potential future experimental research carrier e.g. preparation of experiment, its execution, analysis and interpretation of measured data, and presentation of results.			
02PRPL2	Laboratory Work in Plasma Physics 2	KZ	2
The main aim of the course Laboratory Work in Plasma Physics is to get students acquainted with several complex experimental devices (tokamaks GOLEM and COMPASS, large laser facility PALS, experimental fission reactor VR-1 VRABEC and others). Besides that, students obtain and strengthen basic skills critical to their potential future experimental research carrier e.g. preparation of experiment, its execution, analysis and interpretation of measured data, and presentation of results.			
02TTJZ	Technology of Thermonuclear Facilities	ZK	3
The course introduces students to the basic problems associated with technical realization of controlled thermonuclear fusion. The aim is to provide students with a starting point for their direct research involvement in development of one of the systems critical for operation of fusion devices. Further, in particular for those students with more emphasis on plasma theory, the course provides a good overview of technical problems, possibilities, and limits associated with operation of fusion devices as these technical limits form boundary conditions for any applicable fusion theory research.			
02TPLA1	Plasma Theory 1	Z,ZK	5
Students will become familiar with plasma theory: charged particle motion, magntetohydrodynamics, waves and instabilities, and statistical description of the plasma.			
02TPLA2	Plasma Theory 2	Z,ZK	5
Students will become familiar with plasma wavws and instabilities. The second part will be devoted to statistical description of the plasma processes.			
02VUTF1	Research Project 1	Z	6
Research project on selected topic under supervisors guidance.			
02VUTF2	Research Project 2	KZ	8
Research project on selected topic under supervisors guidance.			

Code of the group: NMSFTTFPP2
Name of the group: NMSFTTF - povinné předměty 2. ročník
Requirement credits in the group: In this group you have to gain at least 40 credits
Requirement courses in the group: In this group you have to complete at least 6 courses
Credits in the group: 40
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
02DPTF1	**Master Thesis 1** *Vojtěch Svoboda (Gar.)*	Z	10	10	Z,L	PO
02DPTF2	**Master Thesis 2** *Vojtěch Svoboda (Gar.)*	Z	20	20	L,Z	PO
12FLP	**Physics and Human Cognition** *Jiří Langer Jiří Langer (Gar.)*	Z	2	2+0	L	PO
02ITER	**ITER and the Accompanying Programme** *Jan Mlynář Jan Mlynář (Gar.)*	ZK	3	2+0	Z	PO
01MMNS	**Mathematical Modelling of Non-linear Systems** *Michal Beneš Michal Beneš (Gar.)*	ZK	3	2	Z	PO
02PINC	**Pinches** *Pavel Kubeš Pavel Kubeš (Gar.)*	ZK	3	2+0	Z	PO
02STF1	**Seminar FTTF1** ***Jan Mlynář*** *Jiří Limpouch (Gar.)*	Z	2	0+2		PO
02STF2	**Seminar FTTF2** ***Jan Mlynář*** *Jan Mlynář (Gar.)*	Z	3	0+2		PO

Characteristics of the courses of this group of Study Plan: Code=NMSFTTFPP2 Name=NMSFTTF - povinné předměty 2. ročník

02DPTF1	Master Thesis 1	Z	10
Master's thesis on a chosen subject supervised by an adviser.			
02DPTF2	Master Thesis 2	Z	20
Master's thesis on a chosen subject supervised by an adviser.			
12FLP	Physics and Human Cognition	Z	2
W. Heisenberg said that modern physics is the most important philosophical event of the 20tieth century. This course tries to show "why". It describes the present days picture of the universe based on the General theory of relativity and Quantum theory and briefly comments on important milestones of the history of physics and philosophy. It inquires the place of the physics and mathematics in the cultural history of mankind and their influence on the art and discusses some ethical problems of the scientific research.			

02ITER	ITER and the Accompanying Programme	ZK	3
ITER basic parameters, superconducting magnets, vacuum pumping, fuel cycle, cryoplant, nuclear safety, operation scenarios, plasma diagnostics, schedule of construction and operation, international collaboration, projects IFMIF and DEMO, major fusion research centres in the world.			
01MMNS	Mathematical Modelling of Non-linear Systems	ZK	3
The course consists of basic terms and results of the theory of finite- and infinitedimensional dynamical systems generated by evolutionary differential equations, and description of bifurcations and chaos. Second part is devoted to the explanation of basic results of the fractal geometry dealing with attractors of such dynamical systems.			
02PINC	Pinches	ZK	3
In these lectures the students will be acquaint with the discharge principle of the generation of the plasma with the high energy density in which the neutrons are produced. The today knowledge of basic research and application are presented and scenario of future evolution is discussed.			
02STF1	Seminar FTTF1	Z	2
Seminars based on invited lectures given by experts in the field of research and development of thermonuclear fusion. Students are encouraged to participate in seminars of neigbouring fields according to the subject of their diploma thesis.			
02STF2	Seminar FTTF2	Z	3
Seminars based on invited lectures given by experts in the field of research and development of thermonuclear fusion. Students are encouraged to participate in seminars of neigbouring fields according to the subject of their diploma thesis.			

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

Code of the group: NMSFTTFVP
Name of the group: NMSFTTF - 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
12ASF	**Astrophysics** *Petr Kulhánek Petr Kulhánek (Gar.)*	ZK	4	2+2	L	v
12DRP	**Differential Equations on Computer** *Richard Liska Richard Liska (Gar.)*	Z,ZK	5	2+2	Z	v
16DNEU	**Neutron Dosimetry** *Ondřej Ploc Ondřej Ploc (Gar.)*	ZK	2	2+0	3	v
02HSEF	**History, Social and Economical Aspects of Fusion** *Milan Řípa Milan Řípa (Gar.)*	KZ	2	1+0	Z	v
02ZLSTF2	**Summer School of Plasma Physics and Fusion Physics 2** *Vojtěch Svoboda (Gar.)*	Z	1	1týd.	L	v
02NF	**Neutron Physics** *Jiří Vacík Jiří Vacík (Gar.)*	Z,ZK	4	2+2	L	v
01NSPP	**Numerical Simulations of Convection Problems**	KZ	2	1+1	L	v
12NIPL	**Low Temperature Plasmas and Discharges** *Jaroslav Král Jaroslav Král (Gar.)*	Z,ZK	4	4	Z	v
12OPS	**Optical Spectroscopy** *Martin Michl Martin Michl (Gar.)*	ZK	2	2+0	L	v
12SFMC1	**Computer Simulations in Many-particle Physics 1** *Miroslav Kotrla, Milan Předota Richard Liska (Gar.)*	Z,ZK	4	3+1	Z	v
12SFMC2	**Computer Simulations in Many-particle Physics 2** *Richard Liska, Miroslav Kotrla, Milan Předota Richard Liska (Gar.)*	ZK	2	2+0	L	v
12POEX	**Computer Control of Experiments** *Miroslav Čech Miroslav Čech (Gar.)*	Z	2	2+0	L	v
17PRJT	**Nuclear Technology Devices**	ZK	2	2+0	L	v
16REL	**Radiation Effects in Matter** *Kateřina Pilařová Kateřina Pilařová (Gar.)*	ZK	2	2+0	Z	v
11SUPR	**Superconductivity and Low Temperature** *Zdeněk Janů, Martin Ledinský* ***Martin Ledinský*** *Zdeněk Janů (Gar.)*	ZK	4	4	Z	v
12PICF	**Inertial Confinement Fusion** *Jiří Limpouch, Daniel Klír Jiří Limpouch (Gar.)*	KZ	2	2	L	v
02PMCF	**Topics in Magnetic Confinement Fusion** *Jan Mlynář (Gar.)*	KZ	2	0+2	L	v
16ZJT	**Nuclear Technology Devices** *Kamil Augsten, Tomáš Čechák Tomáš Čechák (Gar.)*	ZK	2	2+0	1	v
02ZLSTF1	**Winter School of Plasma Physics and Fusion Physics 1** *Vojtěch Svoboda Vojtěch Svoboda (Gar.)*	Z	1	1týd.	Z	v
01ZPB1	**Introduction to Computer Security 1** *Petr Vokáč* ***Petr Vokáč*** *Petr Vokáč (Gar.)*	Z	2	1+1		v

01ZPB2	**Introduction to Computer Security 2** *Petr Vokáč* ***Petr Vokáč*** *Petr Vokáč (Gar.)*	Z	2	1+1		v
12UM	**Introduction to Management** *Petr Malát Petr Malát (Gar.)*	ZK	2	2+0	Z	v
16ZIVO	**Introduction to Environment** *Lenka Thinová, Hana Bártová Lenka Thinová (Gar.)*	KZ	2	2+0	1	v

Characteristics of the courses of this group of Study Plan: Code=NMSFTTFVP Name=NMSFTTF - volitelné předměty

12ASF	Astrophysics	ZK	4

"Astrophysics" follows up freely the standard lectures from physics. In relatively attractive area then student recapitulates the knowledge of some parts of the physics (mechanics, optics, relativity, quantum mechanics, radiation, differential and integral calculations). Students will become familiar with some numerical methods and some of them will take part in construction of the www pages. The lecture is supplemented with a three-day practical camp course.

12DRP	Differential Equations on Computer	Z,ZK	5

Ordinary differential equations, analytical methods; Ordinary differential equations, numerical methods, Runge-Kutta methods, stability; Partial differential equations, analysis, hyperbolik, parabolic and elliptic equations, posedness of differential equaitons; Partial differential equations, numerical solution, finite difference methods, difference schemes, order of approximation, stability, convergence, modified equation, diffusion, dispersion; Conservation laws and their numerical solution, shallow water equations, Euler equations, Lagrangian methods, ALE methods; Practical computation in Matlab system for numerics and Maple for analysis of schemes.

16DNEU	Neutron Dosimetry	ZK	2

Methods based on nuclear reactions with neutrons, methods based on recoiled nuclei, the time-of-flight method, neutron selectors and monochromators, activation methods, methods of integrating neutron dosimetry, possibilities of use of various methods, calibration of neutron dosimeters and other dose and dose rate measuring instruments.

02HSEF	History, Social and Economical Aspects of Fusion	KZ	2

While a special lecture acts from simpler to complex, from known to new, this lecture proceeds from older to latter. It connects fusion arrangement and figures with its authors. Lectures explain the logic movement of the research of controlled fusion reaction, including necessary or surprising errors and blind alleys. Course brings out place of fusion in community, including function of the popularization and the role of fusion in future power mix. At lectures are fusion news are discussed.

02ZLSTF2	Summer School of Plasma Physics and Fusion Physics 2	Z	1

Regular international "Student Summer School of Plasma and Fusion Physics" should help students to improve their communication skills. Each participating student presents a talk on his research.

02NF	Neutron Physics	Z,ZK	4

Basic properties of neutron, radionuclide neutron sources, accelerator based neutron sources, nuclear research reactors, neutron induced reactions, fission, neutron detection, neutron diffraction, neutron interaction with matter, slowing down and absorption of neutrons, macroscopic description of neutron transport, neutron shielding, physical principles of nuclear facilities for energy production.

01NSPP	Numerical Simulations of Convection Problems	KZ	2

Students will be acquainted with the 2D and 3D numerical simulations of flow problems described by potential, inviscid and viscous flow. It is a transonic flow around a wing profile, in a 2D and 3D lattice, in 2D and 3D channels of different shape, in the boundary layer, and in the modeling of cardiovascular problems. Some cases of turbulent flow simulations are also mentioned.

12NIPL	Low Temperature Plasmas and Discharges	Z,ZK	4

Atomic collision phenomena; basic concepts and relations; elastic scattering; ionization and excitation; three-particle recombination. Brehmsstrahlung; radiative capture; line radiation. Processes in partially ionized gas. Gas in thermodynamic equilibrium. Ionized gas in electric field. Phenomena on electrodes. Breakdown of gas in D.C. and A.C. electric fields. Gas discharges; V-A charakteristics. Glow discharge. Self-sustaining D.C. arc discharge. Low pressure discharge with heated cathode. Electrical probes.

12OPS	Optical Spectroscopy	ZK	2

Basics of spectroscopic behaviour of atoms and molecules. Elementary experimental techniques for optical spectroscopy.

12SFMC1	Computer Simulations in Many-particle Physics 1	Z,ZK	4

Computer simulation types and possibilities, classical continuous and lattice model systems, principles of the Monte Carlo and molecular dynamics methods, the Ising model, model of hard spheres and of Lennard-Jones liquid, realization of simulations and measurement, simulations in various thermodynamic ensembles.

12SFMC2	Computer Simulations in Many-particle Physics 2	ZK	2

Advanced methods of Monte Carlo and molecular dynamics and their applications to various problems: critical phenomena, complex molecules, non-equilibrium phenomena, transport coefficients, kinetic MC, optimalization problems, quantum MC, ab initio simulations, Car-Parrinello method.

12POEX	Computer Control of Experiments	Z	2

Introduction. Basic design of computers, microcomputers. Hardware: computer-experiment interconnection (interfaces RS232C,IEE488, A/D and D/A converters, sensors, drivers, etc.) Software: operating systems for control of experiments (real time OS, multitasking, multiuser). Basic theory of control systems. Programming languages for control (assembler, C, etc.) Introduction to TCP/IP protocols. Control of experiments via Internet.

17PRJT	Nuclear Technology Devices	ZK	2

The course is focused on instrumentation for neutron detection and gamma ray spectrometry used for reactor experiments and neutron instrumentation of nuclear facilities. The lecture is supplemented by practical demonstrations of equipment used at the VR-1 reactor.

16REL	Radiation Effects in Matter	ZK	2

History of radiolysis, track, stages of radiolysis, reaction kinetics, radiation chemical yield, experiments in radiolysis, classical methods, pulse radiolysis, EPR, primary products of radiolysis, excited states, solvated electrons, free radicals, radiolysis of gases, water, water solutions, organic liquids, radiolysis of solid materials, ionic crystals, polymers, glasses, metals and alloys, radiation technology, sterilisation, crosslinking and degradation of polymers, treatment of foods.

11SUPR	Superconductivity and Low Temperature	ZK	4

The subject of course is: low temperature physics, including cooling methods, low temperature technique, and measurement of low temperatures; macroscopic quantum phenomena in quantum fluids (superfluidity and superconductivity), quantum crystals and diffusion, mesoscopic phenomena in electron systems, quantum Hall effects, Coulomb blockade and single electron transistor.

12PICF	Inertial Confinement Fusion	KZ	2

Main lecture goal is to acquaint students with certain detailed theoretical and experimental methods that have not been taught in subject FIF (Physics of Inertial Fusion).

02PMCF	Topics in Magnetic Confinement Fusion	KZ	2

This course provides an opportunity to students interested in magnetic confinement fusion to enhance their knowledge of fusion physics and technology by special topics that are not covered by the mainstream courses. At the same time, it is a platform where students can meet young research scientists from the COMPASS tokamak. In the end of the course students are expected to present results of their own research task.

16ZJT	Nuclear Technology Devices	ZK	2

Basic scheme of nuclear reactor and nuclear power plant, chain fission reaction development, factors influencing reactivity, internal fuel cycle, 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.

02ZLSTF1	Winter School of Plasma Physics and Fusion Physics 1	Z	1
Regular international "Student Winter School of Plasma and Fusion Physics" should help students to improve their communication skills. Each participating student presents a talk on his research.			
01ZPB1	Introduction to Computer Security 1	Z	2
01ZPB2	Introduction to Computer Security 2	Z	2
12UM	Introduction to Management	ZK	2
Modern management conception, managerial functions, managerial activities . Managerial decision tasks, business strategy. Human resources management, Staff motivation and evaluation, teamwork, labour code. System marketing conception, marketing goals, marketing strategy. Marketing planning and decision making. Marketing mix, product life cycle, publicity campaign.			
16ZIVO	Introduction to Environment	KZ	2
Ozone layer reduction, global warming (greenhouse effect), acid rain, smog, chemicalization, astrophysical theory, cosmic rays, primordial elements, atmosphere contamination, measuring of imissions and emissions, hydrosphere, waste dumping, fossil fuel, alternative sources, solar energy, water energy, wind energy, geothermal energy, biomass combustion, hydrogen energetic, galvanic and fuel couples, principle of sustainable development			

List of courses of this pass:

Code	Name of the course	Completion	Credits
01MMNS	Mathematical Modelling of Non-linear Systems	ZK	3
The course consists of basic terms and results of the theory of finite- and infinitedimensional dynamical systems generated by evolutionary differential equations, and description of bifurcations and chaos. Second part is devoted to the explanation of basic results of the fractal geometry dealing with attractors of such dynamical systems.			
01NSPP	Numerical Simulations of Convection Problems	KZ	2
Students will be acquainted with the 2D and 3D numerical simulations of flow problems described by potential, inviscid and viscous flow. It is a transonic flow around a wing profile, in a 2D and 3D lattice, in 2D and 3D channels of different shape, in the boundary layer, and in the modeling of cardiovascular problems. Some cases of turbulent flow simulations are also mentioned.			
01ZPB1	Introduction to Computer Security 1	Z	2
01ZPB2	Introduction to Computer Security 2	Z	2
02AMF	Atomic and Molecular Physics	Z,ZK	4
This lecture course provides a theoretical introduction to atomic and molecular physics.			
02DPLA	Plasma Diagnostics	Z,ZK	3
The goal of the lecture is to obtain the overview of measurements of basic parameters of hot plasma and their components - density, temperature, electromagnetic fields, radiation and energy and temporal and spatial distribution. The students will acquaint with principles, methodic, demonstration, examples and application of basic diagnostics.			
02DPTF1	Master Thesis 1	Z	10
Master's thesis on a chosen subject supervised by an adviser.			
02DPTF2	Master Thesis 2	Z	20
Master's thesis on a chosen subject supervised by an adviser.			
02FT	Physics of Tokamaks	Z,ZK	4
Students will be introduced in detail to physics of tokamak experiments. The course will be focused on the physics context, terminology and phenomenology of the subject so that the participants can substantially improve their capacity to search for information and to work independently with scientific literature.			
02HSEF	History, Social and Economical Aspects of Fusion	KZ	2
While a special lecture acts from simpler to complex, from known to new, this lecture proceeds from older to latter. It connects fusion arrangement and figures with its authors. Lectures explain the logic movement of the research of controlled fusion reaction, including necessary or surprising errors and blind alleys. Course brings out place of fusion in community, including function of the popularization and the role of fusion in future power mix. At lectures are fusion news are discussed.			
02ITER	ITER and the Accompanying Programme	ZK	3
ITER basic parameters, superconducting magnets, vacuum pumping, fuel cycle, cryoplant, nuclear safety, operation scenarios, plasma diagnostics, schedule of construction and operation, international collaboration, projects IFMIF and DEMO, major fusion research centres in the world.			
02NF	Neutron Physics	Z,ZK	4
Basic properties of neutron, radionuclide neutron sources, accelerator based neutron sources, nuclear research reactors, neutron induced reactions, fission, neutron detection, neutron diffraction, neutron interaction with matter, slowing down and absorption of neutrons, macroscopic description of neutron transport, neutron shielding, physical principles of nuclear facilities for energy production.			
02PINC	Pinches	ZK	3
In these lectures the students will be acquaint with the discharge principle of the generation of the plasma with the high energy density in which the neutrons are produced. The today knowledge of basic research and application are presented and scenario of future evolution is discussed.			
02PMCF	Topics in Magnetic Confinement Fusion	KZ	2
This course provides an opportunity to students interested in magnetic confinement fusion to enhance their knowledge of fusion physics and technology by special topics that are not covered by the mainstream courses. At the same time, it is a platform where students can meet young research scientists from the COMPASS tokamak. In the end of the course students are expected to present results of their own research task.			
02PMPL	Computer Modelling of Plasma	Z,ZK	3
The goal of the lecture is to acquaint the students with basic methods of computer modelling in physics and to apply these techniques to the study of physical processes in both low-temperature and high-temperature plasmas.			
02PRPL1	Laboratory Work in Plasma Physics 1	Z	2
The main aim of the course Laboratory Work in Plasma Physics is to get students acquainted with several complex experimental devices (tokamaks GOLEM and COMPASS, large laser facility PALS, experimental fission reactor VR-1 VRABEC and others). Besides that, students obtain and strengthen basic skills critical to their potential future experimental research carrier e.g. preparation of experiment, its execution, analysis and interpretation of measured data, and presentation of results.			

02PRPL2	Laboratory Work in Plasma Physics 2	KZ	2
The main aim of the course Laboratory Work in Plasma Physics is to get students acquainted with several complex experimental devices (tokamaks GOLEM and COMPASS, large laser facility PALS, experimental fission reactor VR-1 VRABEC and others). Besides that, students obtain and strengthen basic skills critical to their potential future experimental research carrier e.g. preparation of experiment, its execution, analysis and interpretation of measured data, and presentation of results.			
02STF1	Seminar FTTF1	Z	2
Seminars based on invited lectures given by experts in the field of research and development of thermonuclear fusion. Students are encouraged to participate in seminars of neigbouring fields according to the subject of their diploma thesis.			
02STF2	Seminar FTTF2	Z	3
Seminars based on invited lectures given by experts in the field of research and development of thermonuclear fusion. Students are encouraged to participate in seminars of neigbouring fields according to the subject of their diploma thesis.			
02TPLA1	Plasma Theory 1	Z,ZK	5
Students will become familiar with plasma theory: charged particle motion, magntetohydrodynamics, waves and instabilities, and statistical description of the plasma.			
02TPLA2	Plasma Theory 2	Z,ZK	5
Students will become familiar with plasma wavws and instabilities. The second part will be devoted to statistical description of the plasma processes.			
02TTJZ	Technology of Thermonuclear Facilities	ZK	3
The course introduces students to the basic problems associated with technical realization of controlled thermonuclear fusion. The aim is to provide students with a starting point for their direct research involvement in development of one of the systems critical for operation of fusion devices. Further, in particular for those students with more emphasis on plasma theory, the course provides a good overview of technical problems, possibilities, and limits associated with operation of fusion devices as these technical limits form boundary conditions for any applicable fusion theory research.			
02VUTF1	Research Project 1	Z	6
Research project on selected topic under supervisors guidance.			
02VUTF2	Research Project 2	KZ	8
Research project on selected topic under supervisors guidance.			
02ZLSTF1	Winter School of Plasma Physics and Fusion Physics 1	Z	1
Regular international "Student Winter School of Plasma and Fusion Physics" should help students to improve their communication skills. Each participating student presents a talk on his research.			
02ZLSTF2	Summer School of Plasma Physics and Fusion Physics 2	Z	1
Regular international "Student Summer School of Plasma and Fusion Physics" should help students to improve their communication skills. Each participating student presents a talk on his research.			
11SUPR	Superconductivity and Low Temperature	ZK	4
The subject of course is: low temperature physics, including cooling methods, low temperature technique, and measurement of low temperatures; macroscopic quantum phenomena in quantum fluids (superfluidity and superconductivity), quantum crystals and diffusion, mesoscopic phenomena in electron systems, quantum Hall effects, Coulomb blockade and single electron transistor.			
12ASF	Astrophysics	ZK	4
"Astrophysics" follows up freely the standard lectures from physics. In relatively attractive area then student recapitulates the knowledge of some parts of the physics (mechanics, optics, relativity, quantum mechanics, radiation, differential and integral calculations). Students will become familiar with some numerical methods and some of them will take part in construction of the www pages. The lecture is supplemented with a three-day practical camp course.			
12DRP	Differential Equations on Computer	Z,ZK	5
Ordinary differential equations, analytical methods; Ordinary differential equations, numerical methods, Runge-Kutta methods, stability; Partial differential equations, analysis, hyperbolik, parabolic and elliptic equations, posedness of differential equaitons; Partial differential equations, numerical solution, finite difference methods, difference schemes, order of approximation, stability, convergence, modified equation, diffusion, dispersion; Conservation laws and their numerical solution, shallow water equations, Euler equations, Lagrangian methods, ALE methods; Practical computation in Matlab system for numerics and Maple for analysis of schemes.			
12FIF	Inertial Fusion Physics	Z,ZK	4
These lectures aim to introduce to the topic of inertial confinement fusion (ICF). Physical processes, which take place during the individual stages before and after ignition of the fuel are discussed. The problems (instabilities etc.), which make the inertial confinement and the ignition of the fuel more demanding are discussed and their potential solutions are presented. New projects in the field of ICF including some preliminary reactor designes are reviewed.			
12FLP	Physics and Human Cognition	Z	2
W. Heisenberg said that modern physics is the most important philosophical event of the 20tieth century. This course tries to show "why". It describes the present days picture of the universe based on the General theory of relativity and Quantum theory and briefly comments on important milestones of the history of physics and philosophy. It inquires the place of the physics and mathematics in the cultural history of mankind and their influence on the art and discusses some ethical problems of the scientific research.			
12NIPL	Low Temperature Plasmas and Discharges	Z,ZK	4
Atomic collision phenomena; basic concepts and relations; elastic scattering; ionization and excitation; three-particle recombination. Brehmsstrahlung; radiative capture; line radiation. Processes in partially ionized gas. Gas in thermodynamic equilibrium. Ionized gas in electric field. Phenomena on electrodes. Breakdown of gas in D.C. and A.C. electric fields. Gas discharges; V-A charakteristics. Glow discharge. Self-sustaining D.C. arc discharge. Low pressure discharge with heated cathode. Electrical probes.			
12OPS	Optical Spectroscopy	ZK	2
Basics of spectroscopic behaviour of atoms and molecules. Elementary experimental techniques for optical spectroscopy.			
12PICF	Inertial Confinement Fusion	KZ	2
Main lecture goal is to acquaint students with certain detailed theoretical and experimental methods that have not been taught in subject FIF (Physics of Inertial Fusion).			
12POEX	Computer Control of Experiments	Z	2
Introduction. Basic design of computers, microcomputers. Hardware: computer-experiment interconnection (interfaces RS232C,IEE488, A/D and D/A converters, sensors, drivers, etc.) Software: operating systems for control of experiments (real time OS, multitasking, multiuser). Basic theory of control systems. Programming languages for control (assembler, C, etc.) Introduction to TCP/IP protocols. Control of experiments via Internet.			
12SFMC1	Computer Simulations in Many-particle Physics 1	Z,ZK	4
Computer simulation types and possibilities, classical continuous and lattice model systems, principles of the Monte Carlo and molecular dynamics methods, the Ising model, model of hard spheres and of Lennard-Jones liquid, realization of simulations and measurement, simulations in various thermodynamic ensembles.			
12SFMC2	Computer Simulations in Many-particle Physics 2	ZK	2
Advanced methods of Monte Carlo and molecular dynamics and their applications to various problems: critical phenomena, complex molecules, non-equilibrium phenomena, transport coefficients, kinetic MC, optimalization problems, quantum MC, ab initio simulations, Car-Parrinello method.			

12UM	Introduction to Management	ZK	2
Modern management conception, managerial functions, managerial activities . Managerial decision tasks, business strategy. Human resources management, Staff motivation and evaluation, teamwork, labour code. System marketing conception, marketing goals, marketing strategy. Marketing planning and decision making. Marketing mix, product life cycle, publicity campaign.			
14NMR	Materials Science for Reactors	ZK	2
Materials for classical and fusion reactors			
16DNEU	Neutron Dosimetry	ZK	2
Methods based on nuclear reactions with neutrons, methods based on recoiled nuclei, the time-of-flight method, neutron selectors and monochromators, activation methods, methods of integrating neutron dosimetry, possibilities of use of various methods, calibration of neutron dosimeters and other dose and dose rate measuring instruments.			
16REL	Radiation Effects in Matter	ZK	2
History of radiolysis, track, stages of radiolysis, reaction kinetics, radiation chemical yield, experiments in radiolysis, classical methods, pulse radiolysis, EPR, primary products of radiolysis, excited states, solvated electrons, free radicals, radiolysis of gases, water, water solutions, organic liquids, radiolysis of solid materials, ionic crystals, polymers, glasses, metals and alloys, radiation technology, sterilisation, crosslinking and degradation of polymers, treatment of foods.			
16ZIVO	Introduction to Environment	KZ	2
Ozone layer reduction, global warming (greenhouse effect), acid rain, smog, chemicalization, astrophysical theory, cosmic rays, primordial elements, atmosphere contamination, measuring of imissions and emissions, hydrosphere, waste dumping, fossil fuel, alternative sources, solar energy, water energy, wind energy, geothermal energy, biomass combustion, hydrogen energetic, galvanic and fuel couples, principle of sustainable development			
16ZJT	Nuclear Technology Devices	ZK	2
Basic scheme of nuclear reactor and nuclear power plant, chain fission reaction development, factors influencing reactivity, internal fuel cycle, 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.			
17PRJT	Nuclear Technology Devices	ZK	2
The course is focused on instrumentation for neutron detection and gamma ray spectrometry used for reactor experiments and neutron instrumentation of nuclear facilities. The lecture is supplemented by practical demonstrations of equipment used at the VR-1 reactor.			

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