Study plan

Name of study plan: Inženýrství pevných látek

Faculty/Institute/Others: Department: Branch of study guaranteed by the department: Welcome page Garantor of the study branch: Program of study: Solid State Engineering Type of study: Follow-up master full-time Required credits: 0 Elective courses credits: 120 Sum of credits in the plan: 120 Note on the plan:

Name of the block: Compulsory courses in the program Minimal number of credits of the block: 0 The role of the block: P

Code of the group: NMSPIPL1 Name of the group: MDP P_IPLN 1st year Requirement credits in the group: Requirement courses in the group: In this group you have to complete at least 11 courses Credits in the group: 0

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
11FDEL	Physics of Dielectrics Zden k Bryknar, Kate ina Aubrechtová Dragounová Kate ina Aubrechtová Dragounová Kate ina Aubrechtová Dragounová (Gar.)	ZK	2	2P+0C	L	Ρ
11FKOV	Physics of Metals Hanuš Seiner Hanuš Seiner (Gar.)	ZK	2	2P+0C	Z	Р
11FMGL	Physics of Magnetic Solids Jaroslav Hamrle, Štefan Zajac Štefan Zajac Jaroslav Hamrle (Gar.)	ZK	2	2P+0C	L	Ρ
11POLO	Physics of Semiconductors Martin Ledinský Martin Ledinský (Gar.)	ZK	4	4P+0C	Z	Р
11PSP	Practical Exercises from Solid State Structure Analysis Ji í apek, Monika Ku eráková Ji í apek (Gar.)	KZ	6		Z	Р
11SAE1	Seminar and Excursions 1 Jan Drahokoupil, Petr Kolenko Jan Drahokoupil (Gar.)	Z	5		Z	Р
11SMEX1	Seminar and Excursions 1 Jan Drahokoupil	Z	4	2P+2S	Z	Р
11SAE2	Seminar and Excursions 2 Jan Drahokoupil, Petr Kolenko Jan Drahokoupil (Gar.)	Z	5		L	Р
11SMEX2	Seminar and Excursions 2 Jan Drahokoupil	Z	4	2P+2S	L	Р
11STPL	Seminar in Solid State Theory Hanuš Seiner, Petr Sedlák, Dalibor Rep ek Hanuš Seiner Petr Sedlák (Gar.)	KZ	2	0+2	L	Р
11TPL1	Solid State Theory 1 Jaroslav Hamrle, Ladislav Kalvoda Ladislav Kalvoda Jaroslav Hamrle (Gar.)	ZK	6	4+0	Z	Р
11TPL2	Solid State Theory 2 Jaroslav Hamrle, Ladislav Kalvoda Ladislav Kalvoda (Gar.)	ZK	3	2+0	L	Р
11VUIP1	Research Project 1 Ladislav Kalvoda Ladislav Kalvoda (Gar.)	Z	6	0+6	Z	Р
11VUIP2	Research Project 2 Ladislav Kalvoda Ladislav Kalvoda Ladislav Kalvoda (Gar.)	KZ	8	0+8	L	Р

Characteristics of the courses of this group of Study Plan: Code=NMSPIPL1 Name=MDP P_IPLN 1st year

11FDEL	Physics of Dielectrics	ZK	2
Electrical, thermal, and	mechanical properties of dielectrics and switching of polarization in ferroelectrics are described in details. Interaction of election	tromagnetic field	with dielectric
materials is studied in a	wide frequency range from point of view of classical and quantum physics.		
11FKOV	Physics of Metals	ZK	2
The nurnose of this lect	ure is to introduce the undergraduate students to the study of the physical properties of metals and allows	•	•

11FMGL	Physics of Magnetic Solids	ZK	2
The origin of the m	nagnetic moment. Fundamental magnetic interactions. Magnetic susceptibility. Diamagnetism and paramagnetism. Substanc	ces with spontaneous ma	agnetization -
ferromagnetic, anti	iferromagnetic, ferrimagnetic ordering. Domain structure and magnetization processes. Magnetic relaxation and resonance	phenomena. Spintronics	š.
11POLO	Physics of Semiconductors	ZK	4
Lectures give an o	overview of fundamental physical phenomena used for design and operation of semiconductor elements. Physics of electric,	galvanomagnetic, therm	noelectric,
hermomagnetic, p	photoelectric and optical properties of intrinsic and doped semiconductors is explained in detail with respect to possibilities of the	eir effective modification a	and optimizatio
Considerable atter	ntion is also paid to explanation of the properties of P-N junction and metal-semiconductor contact.		
11PSP	Practical Exercises from Solid State Structure Analysis	KZ	6
The aim of this pra	actical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of struct	cture dependant propert	ies of solids.
11SAE1	Seminar and Excursions 1	Z	5
The subject is reco	ommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduate	s and undergraduates	
	Sominar and Evolutions 1	7	4
11SMEX1	Seminar and Excursions 1	<u> </u>	
	Seminal and Excursions i ommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduate:	-	т
11SMEX1 The subject is reco 11SAE2		-	5
The subject is reco 11SAE2	ommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduate	s and undergraduates	5
The subject is reco 11SAE2 Excursions of stude	ommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduate: Seminar and Excursions 2	s and undergraduates	5
The subject is reco 11SAE2 Excursions of stude on hot topics of so	ommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduate: Seminar and Excursions 2 lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstra	s and undergraduates	5
The subject is reco 11SAE2 Excursions of studion hot topics of so 11SMEX2	ommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduate: Seminar and Excursions 2 lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstra plid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.	s and undergraduates	5 ation of studer 4
The subject is reco 11SAE2 Excursions of studion not topics of so 11SMEX2 Excursions of studion	ommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduates Seminar and Excursions 2 lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstra blid state physics. Discussion of own research results and their presentation as a training for defenses of students theses. Seminar and Excursions 2	s and undergraduates	5 ation of studer 4
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The subject is reco 11SAE2 Excursions of studion hot topics of so 11SMEX2 Excursions of studion hot topics of so 11STPL The purpose of this	ommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduated Seminar and Excursions 2 lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstration state physics. Discussion of own research results and their presentation as a training for defenses of students theses. Seminar and Excursions 2 lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstration selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstration blid state physics. Discussion of own research results and their presentation as a training for defenses of students theses. Seminar and Excursions 2 lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstration selected departments of partner universities and their presentation as a training for defenses of students theses. Seminar in Solid State Theory	s and undergraduates s and undergraduates ations and active particip Z ations and active particip Z ations and active particip	5 ation of studer 4 ation of studer
The subject is reco 11SAE2 Excursions of studion hot topics of so 11SMEX2 Excursions of studion hot topics of so 11STPL The purpose of this 11TPL1	ommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduated Seminar and Excursions 2 lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstration lid state physics. Discussion of own research results and their presentation as a training for defenses of students theses. Seminar and Excursions 2 lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstration lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstration selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstration selected departments of partner universities and their presentation as a training for defenses of students theses. Seminar in Solid State Theory is lecture is to solve numerical problems of theory of solids and physics of condensed state.	s and undergraduates s and undergraduates Z ations and active particip Z ations and active particip KZ XZ	5 ation of studen 4 ation of studen 2 6
The subject is reco 11SAE2 Excursions of study on hot topics of so 11SMEX2 Excursions of study on hot topics of so 11STPL The purpose of this 11TPL1 Types of bonds in so	ommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduate Seminar and Excursions 2 lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstra plid state physics. Discussion of own research results and their presentation as a training for defenses of students theses. Seminar and Excursions 2 lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstration as a training for defenses of students theses. Seminar and Excursions 2 lents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrational state physics. Discussion of own research results and their presentation as a training for defenses of students theses. Seminar in Solid State Theory is lecture is to solve numerical problems of theory of solids and physics of condensed state. Solid State Theory 1 solids. Symmetry of crystalline solids. Vibrations of crystalline lattice and its thermal properties. Band electron structure of c	s and undergraduates s and undergraduates Z ations and active particip Z ations and active particip KZ XZ	5 ation of studer ation of studer 2 6
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Code of the group: NMSPIPL2

Name of the group: MDP P_IPLN 2nd year

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 8 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
11DPIP1	Master Thesis 1 Ladislav Kalvoda Ladislav Kalvoda Ladislav Kalvoda (Gar.)	Z	10	0+10	Z	Р
11DPIP2	Master Thesis 2 Ladislav Kalvoda Ladislav Kalvoda Ladislav Kalvoda (Gar.)	Z	20	0+20	L	Ρ
11FPOR	Physics of Surfaces and Interfaces Ladislav Kalvoda Ladislav Kalvoda (Gar.)	ZK	2	2P+0C	Z	Ρ
11OPTX	Optical Properties of Solids Zden k Bryknar, Eva Mihóková Eva Mihóková Eva Mihóková (Gar.)	ZK	2	2P+0C	Z	Р
11SIKL	Computer Simulation of Condensed Matter Ladislav Kalvoda Ladislav Kalvoda Ladislav Kalvoda (Gar.)	ZK	4	2+2	Z,L	Ρ
11SIK	Computer Simulation of Condensed Matter Petr Sedlák, Ladislav Kalvoda Ladislav Kalvoda (Gar.)	Z,ZK	5		Z	Ρ
11SAE3	Seminar and Excursions 3 Jan Drahokoupil, Petr Kolenko Jan Drahokoupil (Gar.)	Z	5		Z	Р
11SMEX3	Seminar and Excursions 3 Petr Kolenko	Z	4	2P+2S	Z	Р
11SMEX4	Seminar and Excursions 4 Petr Kolenko	Z	4	2P+2S	L	Р
11SAE4	Seminar and Excursions 4 Jan Drahokoupil, Petr Kolenko Jan Drahokoupil (Gar.)	Z	5		L	Ρ
11VDM	Intrinsic Dynamics of Materials Hanuš Seiner Hanuš Seiner Hanuš Seiner (Gar.)	ZK	3	2+0	Z	Р

Characteristics of the courses of this group of Study Plan: Code=NMSPIPL2 Name=MDP P_IPLN 2nd year

11DPIP1	Master Thesis 1	Z	10
On the basis of the assi	ignment and under the supervision of the supervisor, the student prepares an individually assigned topic for 2 semesters.		
11DPIP2	Master Thesis 2	Z	20
On the basis of the assi	gnment and under the supervision of the supervisor, the student prepares an individually assigned topic for 2 semesters.		

11FPOR Physics of Surfaces and Interfaces	ZK	2
Description is provided of basic thermodynamic properties, atomary and electronic structure of surfaces and interfaces. The physical models valid for		
with the changes due to introduction of new surface/interface. The theoretical treatment is followed by overview of experimental techniques applied to		
and to study of chemical composition and structural arrangement of the latter. In addition, brief overview is given of simulation approaches suitable for properties of selected systems. All the subjects are demonstrated on praktical exaples of case studies.	or analysis and pr	
	71/	
11OPTX Optical Properties of Solids	ZK	2
This course gives an introductory into the optical properties of solids. The fundamental principles of absorption, reflection, luminescence and light pro-		
range of materials, including crystalline insulators, semiconductors, and metals. Classical and quantum models are used as appropriate, and the ob-	served phenomer	ha are discussed
from point of their application.		
11SIKL Computer Simulation of Condensed Matter	ZK	4
Computer simulation in condensed-matter physics is becoming an important tool used by both experimentalist and theorists to develop new material	s and technologie	s. Thus, solution
of many practical problems can be transferred from the real to a "virtual" laboratory. During the course, students will be introduced to the theoretical	background of ba	sic computation
methods and let to test the acquired knowledge in practical exercises. Each lesson is organized as a tutorial where typical problems are solved with deta	ailed explication of	the computation
methods used. The course is taking place in Computer classroom of the Department of Solid State Physics. Practical demonstration and exercises and	e using Material S	Studio simulation
environment (Accelrys Software Inc.).		
11SIK Computer Simulation of Condensed Matter	Z,ZK	5
Computer simulation in condensed-matter physics is becoming an important tool used by both experimentalist and theorists to develop new material	s and technologie	s. Thus, solution
of many practical problems can be transferred from the real to a "virtual" laboratory. During the course, students will be introduced to the theoretical	background of ba	sic computation
methods and let to test the acquired knowledge in practical exercises. Each lesson is organized as a tutorial where typical problems are solved with deta	ailed explication of	the computation
methods used. The course is taking place in Computer classroom of the Department of Solid State Physics. Practical demonstration and exercises an	e using Material S	Studio simulation
environment (Accelrys Software Inc.).		
11SAE3 Seminar and Excursions 3	Z	5
Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations a	and active particip	ation of students
on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.		
11SMEX3 Seminar and Excursions 3	Z	4
Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations a	and active particip	ation of students
on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.		
11SMEX4 Seminar and Excursions 4	Z	4
Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations a	and active particip	ation of students
on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.		
11SAE4 Seminar and Excursions 4	Z	5
Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations a	and active particip	ation of students
on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.		
11VDM Intrinsic Dynamics of Materials	ZK	3
The course gives an introductory overview of dynamical phenomena taking place in the materials, with the main focus laid on the elastic wave propa	gation (and its int	eraction with the
microstructure), dynamic plasticity, phase transition fronts kinetics, and dynamic fracture mechanics.		

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: NMSPIPLPV1

Name of the group: MDP P_IPLN Required optional courses 1st year

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 1 course Credits in the group: 0

Note on the group:

Student si volí alespoň 1 předmět

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
11EP	Practical Training in Electronics Pavel Jiroušek	KZ	4	0+4	Z	PV
11EPR	Practical Training in Electronics Pavel Jiroušek Pavel Jiroušek (Gar.)	KZ	6		Z	PV
11PPOL	Practical Training of Semiconductors Petr Levinský	KZ	4	4	L	PV
11PFPL	Practical Training of Semiconductors Petr Levinský Petr Levinský (Gar.)	KZ	6		L	PV
11PSP	Practical Exercises from Solid State Structure Analysis Ji í apek, Monika Ku eráková Ji í apek (Gar.)	KZ	6		Z	PV
11PSPL	Practical Exercises from Solid State Structure Analysis Ji í apek	КZ	4	4	Z	PV

Characteristics of the courses of this group of Study Plan: Code=NMSPIPLPV1 Name=MDP P_IPLN Required optional courses 1st year 11PSP Practical Exercises from Solid State Structure Analysis KZ 6 The aim of this practical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of structure dependant properties of solids.

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11EP	Practical Training in Electronics	KZ	4				
Practical training in elec	ctronics gives practical experience in the design of selected electronic circuits. Students obtain basic skill in the circuit realisation	tion. Practical trai	ning includes				
linear circuits, digital cir	cuits and exercise in the programming of microprocessor control system. Students are allowed to work on the electronic probl	em concerning th	eir own scientific				
activity.							
11EPR	Practical Training in Electronics	KZ	6				
Practical training in elec	tronics gives practical experience in the design of selected electronic circuits. Students obtain basic skill in the circuit realisation	tion. Practical trai	ning includes				
linear circuits, digital cir	cuits and exercise in the programming of microprocessor control system. Students are allowed to work on the electronic probl	em concerning th	eir own scientific				
activity.							
11PPOL	Practical Training of Semiconductors	KZ	4				
The aim of this practical	training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of	basic properties of	of semiconductor				
materials and devices.							
11PFPL	Practical Training of Semiconductors	KZ	6				
The aim of this practical	training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of	basic properties of	of semiconductor				
materials and devices.							
11PSPL	Practical Exercises from Solid State Structure Analysis	KZ	4				
The aim of this practica	The aim of this practical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of structure dependant properties of solids.						

Name of the block: Elective courses Minimal number of credits of the block: 0

The role of the block: V

Code of the group: NMSPIPLV Name of the group: MDP P_IPLN Optional courses Requirement credits in the group: Requirement courses in the group: Credits in the group: 0 Note on the group:

vote on the g	jioup.					
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
11AND	Applied Neutron Diffractometry Monika Ku eráková, Stanislav Vratislav Monika Ku eráková Stanislav Vratislav (Gar.)	ZK	2	2	z	V
11CHA	Chemical Aspects of Solids Karel Knížek Karel Knížek Karel Knížek (Gar.)	ZK	2	2	L	V
11DAN	Diffraction Analysis of Mechanical Stress Nikolaj Ganev, Ivo Kraus Nikolaj Ganev Nikolaj Ganev (Gar.)	ZK	2	2	Z	V
11DMSX	Diffraction Methods of Structural Biology Jan Dohnálek Jan Dohnálek Jan Dohnálek (Gar.)	Z,ZK	3	2P+1C	L	V
11FPPL	Physics of Solid State Phase Transitions Ji í Hlinka Ji í Hlinka Ji í Hlinka (Gar.)	ZK	2	2	L	V
12FDD	Physics of Detection and Detectors of Optical Radiation Ladislav Pína Ladislav Pína Ladislav Pína (Gar.)	ZK	2	2+0	Z	V
02FG	Physics of graphene described by Dirac equation Vít Jakubský Vít Jakubský Vít Jakubský (Gar.)	Z	2	2P+0C	L	V
12FOPT	Optical Physics Ivan Richter, Pavel Kwiecien Pavel Kwiecien Ivan Richter (Gar.)	Z,ZK	3	3+0	Z	V
11KO	Metallic Oxides Ji í Hejtmánek Ji í Hejtmánek Ji í Hejtmánek (Gar.)	ZK	2	2	Z,L	V
12KOP	Quantum Optics Ivan Richter, Miroslav Dvo ák Miroslav Dvo ák Ivan Richter (Gar.)	Z,ZK	5	3+1	L	V
11MAM	Magnetic Materials Oleg Heczko Oleg Heczko Oleg Heczko (Gar.)	ZK	2	2+0	Z	V
11MONA	Molecular Nanosystems Irena Kratochvílová Irena Kratochvílová Irena Kratochvílová (Gar.)	ZK	2	2	Z	V
11NAMA	Nanomaterials - Preparation and Characteristics Irena Kratochvílová Irena Kratochvílová Irena Kratochvílová (Gar.)	Z,ZK	2	2+0	L	V
11NMV	Neutronography in Material Research Monika Ku eráková, Stanislav Vratislav Monika Ku eráková Monika Ku eráková (Gar.)	ZK	2	2	L	V
110SAL	Optical Spectroscopy of Inorganic Solids Zden k Pot ek Zden k Pot ek Zden k Pot ek (Gar.)	ZK	2	2	L	V
11PMK1	Macromolecular Crystallography Laboratory 1 Tomáš Kova Tomáš Kova Tomáš Kova (Gar.)	KZ	4	0+4	Z	V
11PMK2	Macromolecular Crystallography Laboratory 2 Tomáš Kova Tomáš Kova Tomáš Kova (Gar.)	KZ	4	0+4	L	V
11PAO	Principles and Applications of Optical Sensors with Practical Trainings Jan Aubrecht Jan Aubrecht Jan Aubrecht (Gar.)	ZK	2	2	L	V

11RTSW	Real Time Software Pavel Jiroušek, Martin Dráb Martin Dráb Pavel Jiroušek (Gar.)	Z	3	2	L	V
11SEM	Scanning Electron Microscopy and Microbeam Analysis Methods	ZK	2	2+0	Z	V
11SMAM	Jaromír Kope ek Jaromír Kope ek Jaromír Kope ek (Gar.) Smart Materials and Their Applications Petr Sedlák, Zden k Pot ek Zden k Pot ek Zden k Pot ek (Gar.)	ZK	2	2+0	L	V
01SUP	Start-up Project Pemysl Rubeš Pemysl Rubeš (Gar.)	KZ	2	2P+0C		V
11SUPR	Superconductivity and Low Temperature Martin Ledinský, Zden k Jan Martin Ledinský Martin Ledinský (Gar.)	ZK	4	4	Z	V
11PCPC	Theory and Construction of Photovoltaic Cells Ji í Pfleger Ji í Pfleger Ji í Pfleger (Gar.)	ZK	2	2	Z	V
11VPSX	Selected Topics of Solid State Structure Jan Drahokoupil Jan Drahokoupil Jan Drahokoupil (Gar.)	Z,ZK	2	1P+1C	L	V
Characteristics of the	courses of this group of Study Plan: Code=NMSPIPLV Name=	MDP P_IPLN	Optiona	l courses	S	
This lecture introduces the neutron scattering are given, 11CHA Che The purpose of this lecture is relations between crystal and 11DAN Diff Course description: The course problems. 11DMSX Diff Determination of 3D structure individual steps of single cryster leading to determination of a 11FPPL Phy A number of interesting properovide unifying view on varied 12FDD Phy Electromagnetic spectrum. Stokes of detector and electror based on internal photoefect. circuits. Human eye. 02FG Phy	blied Neutron Diffractometry eutron diffraction method as the method used in solid state physics research and the r as well as the comparative properties to the X-ray method. The basic concept of this emical Aspects of Solids an interpretation of the chemical bonding in solids. The principle of band structure can delectronic structure are manifested for selected materials. raction Analysis of Mechanical Stress se contains the fundamentals of diffraction stress analysis with a strong emphasis on the raction Methods of Structural Biology a of biological macromolecules, such as proteins, nucleic acids or their complexes, by and also in basic molecular biology research. Individual methods of three-dimension stal diffraction analysis. Practical examples of application in biotechnologies and medi- new molecular structure. /sics of Solid State Phase Transitions erties of crystalline materials are directly related or significantly influenced by occurre bus types phase transitions encountered in solid state physics, with the emphasize or /sics of Detection and Detectors of Optical Radiation ources of electromagnetic radiation. Radiometric and photometric units. Ideal detector inc circuits. Dynamic range. Detectors based on external photoefect. Photocathodes. E . Semiconductor detectors. Scintilators. Detectors of IR, VIS and UV radiation. X-ray d vsics of graphene described by Dirac equation 1. Tight-binding model of graphene and its approximation in terms of Dirac equation. The semiconductor detectors of graphene and its approximation in terms of Dirac equation.	method is illustration lculation is demon e illustrations of the the means of phy al structure detern cine will be discus nce of specific pha continuous symm . External and inte ectron multipliers. etectors Pyroeled	ed by many astrated with e capability sical metho nination will ased. The pr ase transitio hetry brakin mal photoe Microchanr ctricity and p	principles of practical ex. in the help of of X-ray diffra- of X-ray diffra- ds is crucial be explaine acticals will pons. The purp g phase tran fect. Quantu nel plates. Im pyrodetector	amples. ZK Tight-binding ZK action to solve cover several ZK ZK for new trend d with a focus cover several ZK Dose of this cover solutions. ZK m fluctuations age intensifie s. Detector eleg Z	2 method. The 2 e engineering 3 s in c on the basic steps 2 ourse is to 2 c of radiation. rs. Detectors ectronic 2
and related phenomena. Bila nanoribbons,boundary condit	yer graphene, its description and properties in the external magnetic field. Carbon nations and energy. Dirac fermions in curved space, fullerenes. Other Dirac materials.	-	-	asic descrip	tion of graphe	ene
The lecture covers the basics	tical Physics of optical physics. It systematically discusses the optical wave propagation in vacuum	•		media, and o		
	ves. Next, it describes the polarization and its applications, statistical properties of pol tallic Oxides	ychromatic waves	, fundamen		nd multiwave	interference. 2
Crystal structures, chemical c magnetic interactions and lon transition tuned via chemical colossal magnetoresistance	omposition and characteristic electronic properties of oxides is presented. Namely elec g range magnetic order are discussed. Phase transitions as a consequence of mutual i composition and temperature are documented. Orbital, spin and charge ordered (disc manganites, high temperature superconducting cuprates and cobalt oxide thermoelec	nterplay of lattice, ordered) states are	transport ar	specific heat, nd magnetic d using the s	thermoelectrieffects and me salient oxide f	ic coefficient, etal-insulator
The lecture covers the advance	antum Optics ced topics in quantum optics, consequentially to the previous course of Quantum electu			ses especia		
functions. Next, the attention quantum theory of scattering quantum correlation functions and quantum theory of damp (photocounting, intensity inter	of electromagnetic field, quantum description of optical radiation, special states of field is given both to Dirac quantum theory of interaction of quantized electromagnetic field (Rayleigh, Thomson, Raman, resonance fluorescence). The attention is further given bo s), in relation to classical theory. The course is further devoted to generalized higher-or ing (quantum damped harmonic oscillator, Heisenberg-Langevin approach). Finally, the rferometry, Brown-Twiss effect, stellar correlation interferometer, correlation spectrosc antum optics (squeezed states). The lectures are accompanied with practical example	d with a quantum s oth to the quantum der coherence the ne attention is give opy), possibilities	system (incl theory of co eory, cohere en to review	uding sponta oherence (qu nt properties of nonclass	aneous emiss iantum theory s of special sta ical measurin	ion) and of detection, ates of fields, g techniques
11MAM Ma The course deals with a broad is followed by description of it	gnetic Materials I scale of magnetic materials with emphasis on their applications. A brief introduction (re ndividual effects and their usage in recent technics and technologies. We will manifes rtant part of the course is devoted to introduction into measurements of various magr	ferring to the form	the contem	neral theoret		
	lecular Nanosystems is to show possibilities to use selected molecules properties in molecular nanodevices	S			ZK	2
The course describes method	nomaterials - Preparation and Characteristics ds of preparation of nanomaterials, their structure, specific properties and applications			d silicon nar		-
11NMV Neuron Neutron diffraction is a power course introduces to the fund sample size in relation to indu sample size in relation	the subject is to explain the relationships between physical / chemical properties of r utronography in Material Research ful method for a detailed understanding of the static and dynamic properties on atom amental principles of nuclear and magnetic scattering and penetration of thermal neutr strial scaling, neutron penetration though machinable materials (and consequent case sibilities. Examples of the different neutron scattering techniques are given.	ic scale of materia ons. From this poi	als in many nt of view th	field of scien e following a	ZK nces and indus	2 stry. This ry important:

11OSAL	Optical Spectroscopy of Inorganic Solids	ZK	2
Relationship between e	xperimental data and theoretical models that allow us elucidate and predict spectroscopic properties of optical centers in soli	ds, such as absor	ption spectrum,
emission spectrum or de	ecay and efficiency of luminescence, is illustrated by an example of color centers, rare-earth ions, and transition metal ions in	insulators. Partic	ular emphasis
is put on influence of lat	tice symmetry and vibrations on spectroscopic properties of optically active centers. Attention is also paid to physical basis o	f the experimenta	l techniques
commonly used in optic	al spectroscopy of solids, to non-radiative energy transfer between adjacent centers and formation of their aggregates with d	istinct spectrosco	pic properties
occurring in the case of	sufficiently high concentrations of optical centers, and to optical processes operating in solid-state lasers.		
11PMK1	Macromolecular Crystallography Laboratory 1	KZ	4
The subject introduces	the students to practical aspects of macromolecular crystallography.		
11PMK2	Macromolecular Crystallography Laboratory 2	KZ	4
The subject introduces t	the students to computational approaches of macromolecular crystallography.		
11PAO	Principles and Applications of Optical Sensors with Practical Trainings	ZK	2
This course gives an intr	oductory into the optical sensors. The fundamental principles of absorption, luminescence and SPR sensors are discussed for a	a wide range of ap	plication.Course
description: First part of	this course gives an introductory into theory of the electromagnetic field. Second part describes the wave phenomena in me	chanics and elect	romagnetism.
Third part is devoted to	introduction into atomic physics.		
11RTSW	Real Time Software	Z	3
The seminar is the intro	duction to the problematic of the real time software. It describes the specifics of RT software and shows commonly used solu	tions.	
11SEM	Scanning Electron Microscopy and Microbeam Analysis Methods	ZK	2
The aim of the lecture is	to familiarize students with the work on scanning electron microscope (SEM) and the possibilities of bundle analytical method	ds available on su	ch devices. With
regard to physical princi	ples, the display methods, analytical methods available on SEM and sampling techniques will be analyzed. The student shou	ld be able to easi	ly train on a
specific device, after the	e necessary practical training to prepare a sample and choose the right technique for solving a specific problem, but also to m	nake general orier	ntation in the
available experimental t	echniques.		
available experimental t 11SMAM	echniques. Smart Materials and Their Applications	ZK	2
11SMAM		I	
11SMAM Smart or responsive ma	Smart Materials and Their Applications	inges in some exte	ernal conditions.
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11SMAM Smart or responsive ma The properties respondi is growing steadily. Pass cellular phone antennas	Smart Materials and Their Applications terials have one or more properties, such as shape, conductivity or color, that can be dramatically and reversibly altered by cha ng to external stimuli (heat, stress, electric field, light) influences what types of applications the smart material can be used for sive and active vibration damping, airbag sensors, acoustic transducers, precision positioners, miniature ultrasonic motors, variables and active vibration damping.	nges in some extension r. The number of the second	ernal conditions. heir applications eglass frames, es, experimental
11SMAM Smart or responsive ma The properties respondi is growing steadily. Pass cellular phone antennas methods of investigation	Smart Materials and Their Applications terials have one or more properties, such as shape, conductivity or color, that can be dramatically and reversibly altered by cha ng to external stimuli (heat, stress, electric field, light) influences what types of applications the smart material can be used for sive and active vibration damping, airbag sensors, acoustic transducers, precision positioners, miniature ultrasonic motors, va , light sensitive glasses or photochromic and thermochromic clothes could serve as a few examples. Lectures are focused on	nges in some exte r. The number of th ascular stents, eye physical propertie dielectric elastome	ernal conditions. heir applications eglass frames, es, experimental ers, ferroelectric
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List of courses of this pass:

Code	Name of the course	Completion	Credits
01SUP	Start-up Project	KZ	2
02FG	Physics of graphene described by Dirac equation	Z	2
General description	n of crystal. Tight-binding model of graphene and its approximation in terms of Dirac equation. Transport of Dirac fermions in graphen	e in presence of ex	ternal fields
and related pl	nenomena. Bilayer graphene, its description and properties in the external magnetic field. Carbon nanotubes, their classification. Basi	c description of gra	aphene
	nanoribbons, boundary conditions and energy. Dirac fermions in curved space, fullerenes. Other Dirac materials.		
11AND	Applied Neutron Diffractometry	ZK	2
This lecture introdu	ces the neutron diffraction method as the method used in solid state physics research and the materials sciences. The basic principle	es of the nuclear ar	nd magnetic
neutron s	cattering are given, as well as the comparative properties to the X-ray method. The basic concept of this method is illustrated by mar	y practical example	es.
11CHA	Chemical Aspects of Solids	ZK	2
The purpose of this	secture is an interpretation of the chemical bonding in solids. The principle of band structure calculation is demonstrated with the hel	p of Tight-binding r	nethod. The
	relations between crystal and electronic structure are manifested for selected materials.		
11DAN	Diffraction Analysis of Mechanical Stress	ZK	2
Course description	The course contains the fundamentals of diffraction stress analysis with a strong emphasis on the illustrations of the capability of X-ray	diffraction to solve	engineering
	problems.		
11DMSX	Diffraction Methods of Structural Biology	Z,ZK	3
Determination	of 3D structure of biological macromolecules, such as proteins, nucleic acids or their complexes, by the means of physical methods	is crucial for new tr	ends in
biotechnologies	biomedicine and also in basic molecular biology research. Individual methods of three-dimensional structure determination will be e	xplained with a foc	us on the
individual steps of	single crystal diffraction analysis. Practical examples of application in biotechnologies and medicine will be discussed. The practicals	will cover several	basic steps
	leading to determination of a new molecular structure.		

11DPIP1	Master Thesis 1	Z	10
	On the basis of the assignment and under the supervision of the supervisor, the student prepares an individually assigned topic for 2	semesters.	
11DPIP2	Master Thesis 2	Z	20
	On the basis of the assignment and under the supervision of the supervisor, the student prepares an individually assigned topic for 2	semesters.	
11EP	Practical Training in Electronics	KZ	4
Practical training	in electronics gives practical experience in the design of selected electronic circuits. Students obtain basic skill in the circuit realisation	n. Practical training	g includes
linear circuits, digit	tal circuits and exercise in the programming of microprocessor control system. Students are allowed to work on the electronic problem	concerning their ov	wn scientific
	activity.		
11EPR	Practical Training in Electronics	KZ	6
-	in electronics gives practical experience in the design of selected electronic circuits. Students obtain basic skill in the circuit realisation		-
linear circuits, digit	tal circuits and exercise in the programming of microprocessor control system. Students are allowed to work on the electronic problem	concerning their ov	wn scientific
	activity.		-
11FDEL	Physics of Dielectrics	ZK	2
Electrical, therma	al, and mechanical properties of dielectrics and switching of polarization in ferroelectrics are described in details. Interaction of electro	magnetic field with	n dielectric
	materials is studied in a wide frequency range from point of view of classical and quantum physics.	714	-
11FKOV	Physics of Metals	ZK	2
	The purpose of this lecture is to introduce the undergraduate students to the study of the physical properties of metals and all	-	
11FMGL	Physics of Magnetic Solids	ZK	2
-	magnetic moment. Fundamental magnetic interactions. Magnetic susceptibility. Diamagnetism and paramagnetism. Substances with		
	etic, antiferromagnetic, ferrimagnetic ordering. Domain structure and magnetization processes. Magnetic relaxation and resonance ph		
11FPOR	Physics of Surfaces and Interfaces	ZK	2
	by ided of basic thermodynamic properties, atomary and electronic structure of surfaces and interfaces. The physical models valid for the structure of surfaces and interfaces.		-
-	due to introduction of new surface/interface. The theoretical treatment is followed by overview of experimental techniques applied to pro-	-	
	chemical composition and structural arrangement of the latter. In addition, brief overview is given of simulation approaches suitable for properties of selected systems. All the subjects are demonstrated on praktical exaples of case studies.	r analysis and pred	
11FPPL		ZK	2
	Physics of Solid State Phase Transitions resting properties of crystalline materials are directly related or significantly influenced by occurrence of specific phase transitions. The		_
	inifying view on various types phase transitions encountered in solid state physics, with the emphasize on continuous symmetry braki		
11KO	Metallic Oxides	ZK	2
-	chemical composition and characteristic electronic properties of oxides is presented. Namely electronic and thermal transport, specific h		
	ons and long range magnetic order are discussed. Phase transitions as a consequence of mutual interplay of lattice, transport, specific		
	via chemical composition and temperature are documented. Orbital, spin and charge ordered (disordered) states are exemplified usin		
	colossal magnetoresistance manganites, high temperature superconducting cuprates and cobalt oxide thermoelectrics.	5	
11MAM	Magnetic Materials	ZK	2
	vith a broad scale of magnetic materials with emphasis on their applications. A brief introduction (referring to the former, more general the		magnetism)
is followed by dea	scription of individual effects and their usage in recent technics and technologies. We will manifest that existence of the contemporary		
is followed by de	scription of individual effects and their usage in recent technics and technologies. We will manifest that existence of the contemporary materials is impossible. Important part of the course is devoted to introduction into measurements of various magnetic properties of the course is devoted to introduct the measurement of the course is devoted to introduct the measurements of various magnetic properties of the course is devoted to introduct the measurements of various magnetic properties of the course is devoted to introduct the measurements of various magnetic properties of the course is devoted to introduct the measurements of various magnetic properties of the course is devoted to introduct the measurement of the course is devoted to introduct the measurements of various magnetic properties of the course is devoted to introduct the measurement of the course is devoted to introduct the measurement of the course is devoted to introduct the measurement of the course is devoted to introduct the measurement of the course is devoted to introduct the measurement of the course is devoted to introduct the measurement of the course is devoted to introduct the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement of the course is devoted to introduce the measurement	civilization without	
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11PMK2			
	Macromolecular Crystallography Laboratory 2 The subject introduces the students to computational approaches of macromolecular crystallography.	KZ	4
11POLO	Physics of Semiconductors	ZK	4
Lectures give ar	n overview of fundamental physical phenomena used for design and operation of semiconductor elements. Physics of electric, galvanc	omagnetic, therm	oelectric,
nermomagnetic, ph	notoelectric and optical properties of intrinsic and doped semiconductors is explained in detail with respect to possibilities of their effective	modification and	optimizatior
	Considerable attention is also paid to explanation of the properties of P-N junction and metal-semiconductor contact.		
11PPOL	Practical Training of Semiconductors	KZ	4
he aim of this prac	tical training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of basic	c properties of se	miconducto
	materials and devices.		
11PSP	Practical Exercises from Solid State Structure Analysis	KZ	6
	ractical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of structure dep		
11PSPL	Practical Exercises from Solid State Structure Analysis	KZ	4
-	ractical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of structure dep		1
		Z	3 01 30/103.
11RTSW	Real Time Software seminar is the introduction to the problematic of the real time software. It describes the specifics of RT software and shows commonly	—	3
			-
11SAE1	Seminar and Excursions 1	Z	5
	ect is recommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduates a		1
11SAE2	Seminar and Excursions 2	Z	5
xcursions of stude	ents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and a	ctive participatio	n of student
	on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students	theses.	
11SAE3	Seminar and Excursions 3	Z	5
xcursions of stude	, ants to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and a	active participatio	n of student
	on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students	theses.	
11SAE4	Seminar and Excursions 4	Z	5
	ents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and a	—	-
	on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students		
11SEM	Scanning Electron Microscopy and Microbeam Analysis Methods	ZK	2
-	ure is to familiarize students with the work on scanning electron microscope (SEM) and the possibilities of bundle analytical methods av		-
	al principles, the display methods, analytical methods available on SEM and sampling techniques will be analyzed. The student should		
	fter the necessary practical training to prepare a sample and choose the right technique for solving a specific problem, but also to mak	-	
specific device, a	available experimental techniques.	te general onena	
44011/		7 71/	5
11SIK	Computer Simulation of Condensed Matter	Z,ZK	-
computer simulatic	on in condensed-matter physics is becoming an important tool used by both experimentalist and theorists to develop new materials and		
	the second se	-	
of many practical p	problems can be transferred from the real to a "virtual" laboratory. During the course, students will be introduced to the theoretical back	ground of basic	computatior
of many practical p	problems can be transferred from the real to a "virtual" laboratory. During the course, students will be introduced to the theoretical back test the acquired knowledge in practical exercises. Each lesson is organized as a tutorial where typical problems are solved with detailed or the theoretical back the solution of the transferred from transferred from the transferred from t	ground of basic	computatior
of many practical p nethods and let to t		ground of basic explication of the	computatior computatior
of many practical p nethods and let to t nethods used. The	test the acquired knowledge in practical exercises. Each lesson is organized as a tutorial where typical problems are solved with detailed	ground of basic explication of the ing Material Stud	computatior computatior
of many practical p methods and let to t	test the acquired knowledge in practical exercises. Each lesson is organized as a tutorial where typical problems are solved with detailed a course is taking place in Computer classroom of the Department of Solid State Physics. Practical demonstration and exercises are usi	ground of basic explication of the	computation computatior
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11TPL2	Solid State Theory 2	ZK	3
	Electric, magnetic and thermal properties of itinerant electrons in solids, Bolzmann kinetic equation, transport and optical phenomer	ha in solids	
11VDM	Intrinsic Dynamics of Materials	ZK	3
The course gives a	n introductory overview of dynamical phenomena taking place in the materials, with the main focus laid on the elastic wave propagat	ion (and its interac	tion with the
	microstructure), dynamic plasticity, phase transition fronts kinetics, and dynamic fracture mechanics.		
11VPSX	Selected Topics of Solid State Structure	Z,ZK	2
The lecture cycle for	cuses on the structure of solids from the point of view of the arrangement of atoms. The first part focuses on application-interesting str	uctures from meta	lic materials
to molecular crysta	Is. In the second part we will look at the possibilities of observing the atomic structure using X-rays, both from the point of view of the a	verage and the loo	al structure.
1	Objective of the course is also the use of special programs designed to study and analyze the structure and microstructure of s	solids.	
11VUIP1	Research Project 1	Z	6
11VUIP2	Research Project 2	KZ	8
12FDD	Physics of Detection and Detectors of Optical Radiation	ZK	2
Electromagnetic sp	ectrum. Sources of electromagnetic radiation. Radiometric and photometric units. Ideal detector. External and internal photoefect. Qua	antum fluctuations	of radiation.
Noise of detector a	nd electronic circuits. Dynamic range. Detectors based on external photoefect. Photocathodes. Electron multipliers. Microchannel plate	s. Image intensifie	rs. Detectors
based on interna	al photoefect. Semiconductor detectors. Scintilators. Detectors of IR, VIS and UV radiation. X-ray detectors Pyroelectricity and pyrod	etectors. Detector	electronic
	circuits. Human eye.		
12FOPT	Optical Physics	Z,ZK	3
The lecture covers	the basics of optical physics. It systematically discusses the optical wave propagation in vacuum, in isotropic and anisotropic media, a	and on their bound	aries. It also
classifies types of	optical waves. Next, it describes the polarization and its applications, statistical properties of polychromatic waves, fundamentals of tw	wo and multiwave i	nterference.
12KOP	Quantum Optics	Z,ZK	5
The lecture covers	the advanced topics in quantum optics, consequentially to the previous course of Quantum electronics. It systematically discusses esp	ecially the statistic	al properties
of radiation, cohe	erent states of electromagnetic field, quantum description of optical radiation, special states of fields, with respect to quasi-probability	densities and cha	racteristic
functions. Next, t	he attention is given both to Dirac quantum theory of interaction of quantized electromagnetic field with a quantum system (including	spontaneous emis	ssion) and
quantum theory of	scattering (Rayleigh, Thomson, Raman, resonance fluorescence). The attention is further given both to the quantum theory of coherence	e (quantum theory	of detection,
•	n functions), in relation to classical theory. The course is further devoted to generalized higher-order coherence theory, coherent prope		
	y of damping (quantum damped harmonic oscillator, Heisenberg-Langevin approach). Finally, the attention is given to review of nonc	•	
(photocounting, int	ensity interferometry, Brown-Twiss effect, stellar correlation interferometer, correlation spectroscopy), possibilities of measuring the qu	-	nt, and some
	selected parts of modern quantum optics (squeezed states). The lectures are accompanied with practical example exercise	es.	

For updated information see <u>http://bilakniha.cvut.cz/en/FF.html</u> Generated: day 2025-06-03, time 02:02.