## 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:

Note on the gro	up:					
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	Р
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	Р
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 (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 elec	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 purpose of this led	ture is to introduce the undergraduate students to the study of the physical properties of metals and alloys.	•	'

11FMGL	Physics of Magnetic Solids	ZK	2
The origin of the ma	ignetic moment. Fundamental magnetic interactions. Magnetic susceptibility. Diamagnetism and paramagnetism. Substances wi	th spontaneous m	agnetization -
ferromagnetic, antife	erromagnetic, ferrimagnetic ordering. Domain structure and magnetization processes. Magnetic relaxation and resonance phenc	mena. Spintronics	S.
11POLO	Physics of Semiconductors	ZK	4
Lectures give an over	erview of fundamental physical phenomena used for design and operation of semiconductor elements. Physics of electric, galva	nomagnetic, thern	noelectric,
thermomagnetic, pho	otoelectric and optical properties of intrinsic and doped semiconductors is explained in detail with respect to possibilities of their effe	ctive modification	and optimization.
Considerable attenti	ion 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 prac	tical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of structure of	dependant propert	ies of solids.
11SAE1	Seminar and Excursions 1	Z	5
The subject is recon	nmended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduates and	undergraduates	•
11SMEX1	Seminar and Excursions 1	Z	4
The subject is recon	nmended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduates and	undergraduates	•
11SAE2	Seminar and Excursions 2	Z	5
_	Seminar and Excursions 2 nts to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations	Z and active particip	_
Excursions of studer		Z and active particip	_
Excursions of studer	nts to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations	Z and active particip	_
Excursions of studer on hot topics of solid 11SMEX2	nts to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations d state physics. Discussion of own research results and their presentation as a training for defenses of students theses.	Z	ation of students
Excursions of studer on hot topics of solid 11SMEX2 Excursions of studer	nts to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations d state physics. Discussion of own research results and their presentation as a training for defenses of students theses.  Seminar and Excursions 2	Z	ation of students
Excursions of studer on hot topics of solid 11SMEX2 Excursions of studer	nts to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations d state physics. Discussion of own research results and their presentation as a training for defenses of students theses.  Seminar and Excursions 2  Into the selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations	Z	ation of students
Excursions of studer on hot topics of solid 11SMEX2 Excursions of studer on hot topics of solid 11STPL	Ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations distate physics. Discussion of own research results and their presentation as a training for defenses of students theses.  Seminar and Excursions 2 Ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations distate physics. Discussion of own research results and their presentation as a training for defenses of students theses.	Z and active particip	ation of students  4 ation of students
Excursions of studer on hot topics of solid 11SMEX2 Excursions of studer on hot topics of solid 11STPL	Ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations of state physics. Discussion of own research results and their presentation as a training for defenses of students theses.  Seminar and Excursions 2  Seminar and Excursions 2  state physics. Discussion of own research results and institutes of Czech Academy of Sciences (CAS). Practical demonstrations of state physics. Discussion of own research results and their presentation as a training for defenses of students theses.  Seminar in Solid State Theory  lecture is to solve numerical problems of theory of solids and physics of condensed state.	Z and active particip	ation of students  4 ation of students
Excursions of studer on hot topics of solid 11SMEX2 Excursions of studer on hot topics of solid 11STPL The purpose of this 11TPL1	Ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations of state physics. Discussion of own research results and their presentation as a training for defenses of students theses.  Seminar and Excursions 2 Ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations of state physics. Discussion of own research results and their presentation as a training for defenses of students theses.  Seminar in Solid State Theory	Z and active particip	ation of students  4 ation of students  2
Excursions of studer on hot topics of solid 11SMEX2 Excursions of studer on hot topics of solid 11STPL The purpose of this 11TPL1	Ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations of state physics. Discussion of own research results and their presentation as a training for defenses of students theses.    Seminar and Excursions 2     Seminar and Excursions 2     Ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations of state physics. Discussion of own research results and their presentation as a training for defenses of students theses.    Seminar in Solid State Theory	Z and active particip	ation of students  4 ation of students  2  6
Excursions of studer on hot topics of solid 11SMEX2 Excursions of studer on hot topics of solid 11STPL The purpose of this 11TPL1 Types of bonds in so	Ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations of state physics. Discussion of own research results and their presentation as a training for defenses of students theses.    Seminar and Excursions 2     Seminar and Excursions 2     Ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations of state physics. Discussion of own research results and their presentation as a training for defenses of students theses.    Seminar in Solid State Theory	Z and active particip	ation of students  4 ation of students  2
Excursions of studer on hot topics of solid 11SMEX2 Excursions of studer on hot topics of solid 11STPL The purpose of this 11TPL1 Types of bonds in so electrons in nonidear 11TPL2	Ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations of state physics. Discussion of own research results and their presentation as a training for defenses of students theses.    Seminar and Excursions 2	Z and active particip  KZ  ZK ine solids. Localize	ation of students  4 ation of students  2  6 ed states of
Excursions of studer on hot topics of solid 11SMEX2 Excursions of studer on hot topics of solid 11STPL The purpose of this 11TPL1 Types of bonds in so electrons in nonidear 11TPL2	Ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations of state physics. Discussion of own research results and their presentation as a training for defenses of students theses.    Seminar and Excursions 2	Z and active particip  KZ  ZK ine solids. Localize	ation of students  4 ation of students  2  6 ed states of

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:

Note on the g	Jroup.					
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 (Gar.)	Z	10	0+10	Z	Р
11DPIP2	Master Thesis 2 Ladislav Kalvoda Ladislav Kalvoda (Gar.)	Z	20	0+20	L	Р
11FPOR	Physics of Surfaces and Interfaces Ladislav Kalvoda Ladislav Kalvoda (Gar.)	ZK	2	2P+0C	Z	Р
11OPTX	Optical Properties of Solids Zden k Bryknar, Eva Mihóková Eva Mihóková (Gar.)	ZK	2	2P+0C	Z	Р
11SIKL	Computer Simulation of Condensed Matter Ladislav Kalvoda Ladislav Kalvoda (Gar.)	ZK	4	2+2	Z,L	Р
11SIK	Computer Simulation of Condensed Matter Petr Sedlák, Ladislav Kalvoda Ladislav Kalvoda (Gar.)	Z,ZK	5		Z	Р
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	Р
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	gnment 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	ignment and under the supervision of the supervisor, the student prepares an individually assigned topic for 2 semesters.	,	

Physics of Surfaces and Interfaces Description is provided of basic thermodynamic properties, atomary and electronic structure of surfaces and interfaces. The physical models valid for bulk sysstems are juxtaposed with the changes due to introduction of new surface/interface. The theoretical treatment is followed by overview of experimental techniques applied to preparation of surface structures and to study of chemical composition and structural arrangement of the latter. In addition, brief overview is given of simulation approaches suitable for analysis and prediction of properties of selected systems. All the subjects are demonstrated on praktical exaples of case studies. 11OPTX Optical Properties of Solids ΖK 2 This course gives an introductory into the optical properties of solids. The fundamental principles of absorption, reflection, luminescence and light propagation are discussed for a wide range of materials, including crystalline insulators, semiconductors, and metals. Classical and quantum models are used as appropriate, and the observed phenomena are discussed from point of their application. 11SIKL Computer Simulation of Condensed Matter 7K Computer simulation in condensed-matter physics is becoming an important tool used by both experimentalist and theorists to develop new materials and technologies. 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 basic 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 detailed 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 are using Material Studio simulation environment (Accelrys Software Inc.). 11SIK Computer Simulation of Condensed Matter Z,ZK Computer simulation in condensed-matter physics is becoming an important tool used by both experimentalist and theorists to develop new materials and technologies. 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 basic 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 detailed 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 are using Material Studio simulation environment (Accelrys Software Inc.). 11SAF3 Seminar and Excursions 3 Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation 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 Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation 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. Z 4 Seminar and Excursions 4 Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students

11SMEX4

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 5 Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation 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

The course gives an introductory overview of dynamical phenomena taking place in the materials, with the main focus laid on the elastic wave propagation (and its interaction 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 i apek	KZ	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 Practical Exercises from Solid State Structure Analysis

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

11EP	Practical Training in Electronics	KZ	4
Practical training in e	electronics gives practical experience in the design of selected electronic circuits. Students obtain basic skill in the circuit realisa	tion. Practical train	ning includes
linear circuits, digital	circuits and exercise in the programming of microprocessor control system. Students are allowed to work on the electronic prob	lem concerning the	eir own scientific
activity.			
11EPR	Practical Training in Electronics	KZ	6
Practical training in e	electronics gives practical experience in the design of selected electronic circuits. Students obtain basic skill in the circuit realisa	tion. Practical train	ning includes
linear circuits, digital	circuits and exercise in the programming of microprocessor control system. Students are allowed to work on the electronic prob	lem concerning the	eir own scientific
activity.			
	Practical Training of Semiconductors	KZ	4
activity. 11PPOL		KZ	4
activity. 11PPOL	Practical Training of Semiconductors cal training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of	KZ	4
activity.  11PPOL  The aim of this practi	Practical Training of Semiconductors cal training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of	KZ	4
activity.  11PPOL The aim of this practimaterials and device 11PFPL	Practical Training of Semiconductors cal training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of s.	KZ kasic properties o	4 of semiconductor
activity.  11PPOL The aim of this practimaterials and device 11PFPL	Practical Training of Semiconductors cal training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of s.  Practical Training of Semiconductors cal training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of	KZ kasic properties o	4 of semiconductor
activity.  11PPOL The aim of this practimaterials and device 11PFPL The aim of this practi	Practical Training of Semiconductors cal training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of s.  Practical Training of Semiconductors cal training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of	KZ kasic properties o	4 of semiconductor

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:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their	Completion	Cradita	Saana	ope Semester	Role
Code	members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	KOIE
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 (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 (Gar.)	ZK	2	2	L	V
12FDD	Physics of Detection and Detectors of Optical Radiation Ladislav Pina Ladislav Pina (Gar.)	ZK	2	2+0	Z	V
02FG	Physics of graphene described by Dirac equation 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 (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 (Gar.)	ZK	2	2+0	Z	V
11MONA	Molecular Nanosystems Irena Kratochvílová Irena Kratochvílová (Gar.)	ZK	2	2	Z	V
11NAMA	Nanomaterials - Preparation and Characteristics 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
11OSAL	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 (Gar.)	KZ	4	0+4	Z	V
11PMK2	Macromolecular Crystallography Laboratory 2 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 Jaromír Kope ek Jaromír Kope ek (Gar.)	ZK	2	2+0	Z	V
11SMAM	Smart Materials and Their Applications Petr Sedlák, Zden k Pot ek Zden k Pot ek (Gar.)	ZK	2	2+0	L	V
01SUP	Start-up Project P emysl Rubeš P emysl Rubeš (Gar.)	KZ	2	2P+0C		V
11SUPR	Superconductivity and Low Temperature  Martin Ledinský, Zden k Jan Martin Ledinský (Gar.)	ZK	4	4	Z	V
11PCPC	Theory and Construction of Photovoltaic Cells Ji í Pfleger Ji í Pfleger (Gar.)	ZK	2	2	Z	V
I1VPSX	Selected Topics of Solid State Structure  Jan Drahokoupil Jan Drahokoupil Jan Drahokoupil (Gar.)	Z,ZK	2	1P+1C	L	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	l Option	al course	s	
11AND Applied Neutron Diffractometry				ZK	2
This lecture introduces the neutron diffraction method as the method used in solid state physics research and the					and magnetic
neutron scattering are given, as well as the comparative properties to the X-ray method. The basic concept of this	method is illustra	ted by many			
11CHA   Chemical Aspects of Solids				ZK	2
The purpose of this lecture is an interpretation of the chemical bonding in solids. The principle of band structure of	alculation is demo	nstrated wit	h the help of	Tight-bindin	g method. The
relations between crystal and electronic structure are manifested for selected materials.				71.6	
11DAN Diffraction Analysis of Mechanical Stress	:!!			ZK	2
Course description: The course contains the fundamentals of diffraction stress analysis with a strong emphasis on t	ne illustrations of tr	ne capability	of X-ray diffr	action to solv	e engineering
problems.  11DMCV Diffraction Matheda of Structural Biology				71/	
11DMSX   Diffraction Methods of Structural Biology   Determination of 3D structure of biological macromolecules, such as proteins, nucleic acids or their complexes, but the protein of	y the means of ph	veical moth		Z,ZK	3 de in
biotechnologies, biomedicine and also in basic molecular biology research. Individual methods of three-dimension					
individual steps of single crystal diffraction analysis. Practical examples of application in biotechnologies and medical process of application in biotechnologies and applic			•		
leading to determination of a new molecular structure.		осош. т.то р	racticale IIII	0010.0010.0	Daoie otopo
11FPPL Physics of Solid State Phase Transitions				ZK	2
A number of interesting properties of crystalline materials are directly related or significantly influenced by occurr	ence of specific ph	ase transiti			
provide unifying view on various types phase transitions encountered in solid state physics, with the emphasize of					
12FDD Physics of Detection and Detectors of Optical Radiation				ZK	2
Electromagnetic spectrum. Sources of electromagnetic radiation. Radiometric and photometric units. Ideal detector	r. External and inte	ernal photoe	efect. Quantu	m fluctuation	ns of radiation.
Noise of detector and electronic circuits. Dynamic range. Detectors based on external photoefect. Photocathodes.	Electron multipliers	. Microchan	nel plates. Im	nage intensif	ers. Detectors
based on internal photoefect. Semiconductor detectors. Scintilators. Detectors of IR, VIS and UV radiation. X-ray	detectors Pyroele	ctricity and	pyrodetector	s. Detector e	electronic
circuits. Human eye.					
02FG Physics of graphene described by Dirac equation				Z	2
General description of crystal. Tight-binding model of graphene and its approximation in terms of Dirac equation.	Transport of Dirac	fermions in	graphene in	presence of	external fields
and related phenomena. Bilayer graphene, its description and properties in the external magnetic field. Carbon na	anotubes, their cla	ssification. I	Basic descrip	tion of graph	nene
nanoribbons, boundary conditions and energy. Dirac fermions in curved space, fullerenes. Other Dirac materials.					
12FOPT Optical Physics				,ZK	3
The lecture covers the basics of optical physics. It systematically discusses the optical wave propagation in vacuu	· · · · · · · · · · · · · · · · · · ·	-			
classifies types of optical waves. Next, it describes the polarization and its applications, statistical properties of polarization and its applications.	lychromatic waves	s, tundamer			
11KO   Metallic Oxides	-4	.1 4	1	ZK	2
Crystal structures, chemical composition and characteristic electronic properties of oxides is presented. Namely elemagnetic interactions and long range magnetic order are discussed. Phase transitions as a consequence of mutual		-	-		
transition tuned via chemical composition and temperature are documented. Orbital, spin and charge ordered (di		•	•		
colossal magnetoresistance manganites, high temperature superconducting cuprates and cobalt oxide thermoele	•	C CXCIIIpiiiii	ou using the	Sanorit Oxido	lamiles
12KOP Quantum Optics	0.1.001		7	ZK	5
The lecture covers the advanced topics in quantum optics, consequentially to the previous course of Quantum elec	tronics It systemat	tically discu		, ,	_
of radiation, coherent states of electromagnetic field, quantum description of optical radiation, special states of fie	-	-	-	-	
functions. Next, the attention is given both to Dirac quantum theory of interaction of quantized electromagnetic fie			-		
quantum theory of scattering (Rayleigh, Thomson, Raman, resonance fluorescence). The attention is further given l	oth to the quantun	n theory of c	oherence (qu	antum theor	y of detection,
quantum correlation functions), in relation to classical theory. The course is further devoted to generalized higher-	rder coherence th	eory, coher	ent properties	s of special s	tates of fields,
and quantum theory of damping (quantum damped harmonic oscillator, Heisenberg-Langevin approach). Finally,					
(photocounting, intensity interferometry, Brown-Twiss effect, stellar correlation interferometer, correlation spectros		of measuri	ng the quanti	ım state of li	ght, and some
selected parts of modern quantum optics (squeezed states). The lectures are accompanied with practical example	e exercises.			<b>-</b>	
11MAM   Magnetic Materials			,	ZK	2
The course deals with a broad scale of magnetic materials with emphasis on their applications. A brief introduction (	-	_			
is followed by description of individual effects and their usage in recent technics and technologies. We will manife materials is impossible. Important part of the course is devoted to introduction into measurements of various magnitude.			nporary civilia	zation withou	it magnetic
	netic properties of	solius.		71/	
11MONA   Molecular Nanosystems   The main goal of the lecture is to show possibilities to use selected molecules properties in molecular nanodevice	ac.		- 1	ZK	2
			7	71/	
11NAMA	s The properties	of carbon a		Z,ZK	2
analyzed in detail. The aim of the subject is to explain the relationships between physical / chemical properties of					-
11NMV Neutronography in Material Research				ZK	2
Neutron diffraction is a powerful method for a detailed understanding of the static and dynamic properties on atom	nic scale of materi	als in many			
course introduces to the fundamental principles of nuclear and magnetic scattering and penetration of thermal neu		·=			=
sample size in relation to industrial scaling, neutron penetration though machinable materials ( and consequent cas	· · · · · · · · · · · · · · · · · · ·		_	-	
and magnetic scattering possibilities. Examples of the different neutron scattering techniques are given.					

Relationship between experimental data and theoretical models that allow us elucidate and predict spectroscopic properties of optical centers in solids, such as absorption spectrum emission spectrum or decay and efficiency of luminescence, is illustrated by an example of color centers, rare-earth ions, and transition metal ions in insulators. Particular emphasis is put on influence of lattice symmetry and vibrations on spectroscopic properties of optically active centers. Attention is also paid to physical basis of the experimental techniques commonly used in optical spectroscopy of solids, to non-radiative energy transfer between adjacent centers and formation of their aggregates with distinct spectroscopic 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 the students to computational approaches of macromolecular crystallography.  11PAO   Principles and Applications of Optical Sensors with Practical Trainings   ZK   2   This course gives an introductory into the optical sensors. The fundamental principles of absorption, luminescence and SPR sensors are discussed for a wide range of application. Cours description: First part of this course gives an introductory into theory of the electromagnetic field. Second part describes the wave phenomena in mechanics and electromagnetism. Third part is devoted to introduction into atomic physics.  11RTSW   Real Time Software   Z   3   The seminar is the introduction to the problematic of the real time software. It describes the specifics of RT software and shows commonly used solutions.
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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 methods available on such devices. Wit
regard to physical principles, the display methods, analytical methods available on SEM and sampling techniques will be analyzed. The student should be able to easily train on a
specific device, after the necessary practical training to prepare a sample and choose the right technique for solving a specific problem, but also to make general orientation in the
available experimental techniques.
11SMAM Smart Materials and Their Applications ZK 2
Smart or responsive materials have one or more properties, such as shape, conductivity or color, that can be dramatically and reversibly altered by changes in some external conditions
The properties responding to external stimuli (heat, stress, electric field, light) influences what types of applications the smart material can be used for. The number of their application
is growing steadily. Passive and active vibration damping, airbag sensors, acoustic transducers, precision positioners, miniature ultrasonic motors, vascular stents, eyeglass frames,
cellular phone antennas, light sensitive glasses or photochromic and thermochromic clothes could serve as a few examples. Lectures are focused on physical properties, experimenta
methods of investigation and possible application of color changing materials, light emitting materials, piezoelectric materials, conducting polymers, dielectric elastomers, ferroelectric
materials and shape-memory materials. Attention is also paid to the effect of phase transitions on physical properties of smart materials and to their numerical simulations.
01SUP Start-up Project KZ 2
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.
11PCPC Theory and Construction of Photovoltaic Cells ZK 2
The course is aimed to provide a theoretical background of the photovoltaic solar energy conversion. It is focused not only on the classical crystalline silicon cells but it follows also
modern trends in exploiting new materials, including polymers, and new physical principles. The students will learn mathematical and theoretical background of the photovoltaic effective.
in various functional structures and materials. The part of the course will be dedicated to the practical and economical aspects of the application of solar cells in the distribution power
networks. The life cycle assessment will provide students with better understanding of the relation between the photovoltaic cells application and environmental protection.
11VPSX Selected Topics of Solid State Structure Z,ZK 2
The lecture cycle focuses on the structure of solids from the point of view of the arrangement of atoms. The first part focuses on application-interesting structures from metallic material
to molecular crystals. 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 average and the local structure
Objective of the course is also the use of special programs designed to study and analyze the structure and microstructure of solids.

## 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 descriptio	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	henomena. 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	uces the neutron diffraction method as the method used in solid state physics research and the materials sciences. The basic principle	es of the nuclear a	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 exampl	es.
11CHA	Chemical Aspects of Solids	ZK	2
The purpose of this	s lecture is an interpretation of the chemical bonding in solids. The principle of band structure calculation is demonstrated with the hel	p of Tight-binding	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 to	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.		

		_	1
11DPIP1	Master Thesis 1  On the basis of the assignment and under the supervision of the supervisor, the student prepares an individually assigned topic for 2	Z	10
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		1 20
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 trainir	ng includes
linear circuits, digit	tal circuits and exercise in the programming of microprocessor control system. Students are allowed to work on the electronic problem activity.	concerning their of	own scientifi
11EPR	Practical Training in Electronics	KZ	6
J	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 activity.	concerning their of	own scientific
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 materials is studied in a wide frequency range from point of view of classical and quantum physics.	magnetic field wit	h dielectric
11FKOV	Physics of Metals	ZK	2
micov	The purpose of this lecture is to introduce the undergraduate students to the study of the physical properties of metals and all	I	_
11FMGL	Physics of Magnetic Solids	ZK	2
	magnetic moment. Fundamental magnetic interactions. Magnetic susceptibility. Diamagnetism and paramagnetism. Substances with	l	netization -
ferromagne	etic, antiferromagnetic, ferrimagnetic ordering. Domain structure and magnetization processes. Magnetic relaxation and resonance ph	enomena. Spintro	nics.
11FPOR	Physics of Surfaces and Interfaces	ZK	2
	ovided of basic thermodynamic properties, atomary and electronic structure of surfaces and interfaces. The physical models valid for b	•	
-	due to introduction of new surface/interface. The theoretical treatment is followed by overview of experimental techniques applied to pro-	•	
and to study of	chemical composition and structural arrangement of the latter. In addition, brief overview is given of simulation approaches suitable for	or analysis and pre	ediction of
11FPPL	properties of selected systems. All the subjects are demonstrated on praktical exaples of case studies.  Physics of Solid State Phase Transitions	ZK	2
	resting properties of crystalline materials are directly related or significantly influenced by occurrence of specific phase transitions. The		1
	unifying 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 and magn		
transition tuned	via chemical composition and temperature are documented. Orbital, spin and charge ordered (disordered) states are exemplified usin	on the salient oxide	e families -
		ig the ballotte oxid	
	colossal magnetoresistance manganites, high temperature superconducting cuprates and cobalt oxide thermoelectrics.		
11MAM	colossal magnetoresistance manganites, high temperature superconducting cuprates and cobalt oxide thermoelectrics.  Magnetic Materials	ZK	2
The course deals v	Magnetic Materials with a broad scale of magnetic materials with emphasis on their applications. A brief introduction (referring to the former, more general the	ZK coretical courses o	2 f magnetism
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The course deals verified in various followed by design of the course described analyzed in deals analyzed in relations and in the course gives a range of materials.  11OPTX This course gives a range of materials.  11OSAL Relationship between emission spectrur is put on influence commonly used in the course gives a description: First  11PCPC The course is air modern trends in a in various function networks. The the course is air modern trends in a in various function networks. The the course is air modern trends in a in various function networks. The the course is air modern trends in a trends in the course is air modern trends in a t	Magnetic Materials  with a broad scale of magnetic materials with emphasis on their applications. A brief introduction (referring to the former, more general the 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 Molecular Nanosystems  The main goal of the lecture is to show possibilities to use selected molecules properties in molecular nanodevices.  Nanomaterials - Preparation and Characteristics  bes methods of preparation of nanomaterials, their structure, specific properties and applications. The properties of carbon and silicon etail. The aim of the subject is to explain the relationships between physical / chemical properties of nanoparticulate materials and the Neutronography in Material Research  on is a powerful method for a detailed understanding of the static and dynamic properties on atomic scale of materials in many field o to the fundamental principles of nuclear and magnetic scattering and penetration of thermal neutrons. From this point of view the followition to industrial scaling, neutron penetration though machinable materials (and consequent case of construction of environmental chaman magnetic scattering possibilities. Examples of the different neutron scattering techniques are given.  Optical Properties of Solids  an introductory into the optical properties of solids. The fundamental principles of absorption, reflection, luminescence and light propage, including crystalline insulators, semiconductors, and metals. Classical and quantum models are used as appropriate, and the observation of spectroscopy of Inorganic Solids  een experimental data and theoretical models that allow us elucidate and predict spectroscopic properties of optical centers in solids, more decay and efficiency of luminescence, is illustrated by an example of color centers, rare-earth ions, and transitio	ZK oretical courses of civilization without of solids.  ZK  Z,ZK nanobodies and ir main structural ir main s	magnetism transpection transpection.  2 dayers will be features.  2 dustry. This ry important production contrast are discussed to a spectrum are emphasis dechniques are properties.  2 ation. Course magnetism.  2 collows also voltaic effect oution power election.  6
The course deals verified in various followed by design of the course described analyzed in deals analyzed in relations and in the course gives a range of materials.  11OPTX This course gives a range of materials.  11OSAL Relationship between emission spectrur is put on influence commonly used in the course gives a description: First  11PCPC The course is air modern trends in a in various function networks. The the course is air modern trends in a in various function networks. The the course is air modern trends in a in various function networks. The the course is air modern trends in a trends in the course is air modern trends in a t	Magnetic Materials with a broad scale of magnetic materials with emphasis on their applications. A brief introduction (referring to the former, more general the 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 Molecular Nanosystems  The main goal of the lecture is to show possibilities to use selected molecules properties in molecular nanodevices.  Nanomaterials - Preparation and Characteristics bes methods of preparation of nanomaterials, their structure, specific properties and applications. The properties of carbon and silicon atail. The aim of the subject is to explain the relationships between physical / chemical properties of nanoparticulate materials and the Neutronography in Material Research on is a powerful method for a detailed understanding of the static and dynamic properties on atomic scale of materials in many field o to the fundamental principles of nuclear and magnetic scattering and penetration of thermal neutrons. From this point of view the followition to industrial scaling, neutron penetration though machinable materials (and consequent case of construction of environmental chaman and magnetic scattering possibilities. Examples of the different neutron scattering techniques are given.  Optical Properties of Solids an introductory into the optical properties of solids. The fundamental principles of absorption, reflection, luminescence and light propage, including crystalline insulators, semiconductors, and metals. Classical and quantum models are used as appropriate, and the observation of their application.  Optical Spectroscopy of Inorganic Solids een experimental data and theoretical models that allow us elucidate and predict spectroscopic properties of optical centers in solids, or or decay and efficiency of luminescence, is illustrated by an example of color centers, ra	ZK oretical courses of civilization without of solids.  ZK  Z,ZK nanobodies and ir main structural ir main s	re discussed at magnetism.  2 layers will be features.  2 dustry. This ry important poinc contrast at discussed at ediscussed at emphasis techniques at properties.  2 ation. Course magnetism.  2 collows also voltaic effect oution power election.
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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		
	n overview of fundamental physical phenomena used for design and operation of semiconductor elements. Physics of electric, galvar		· · · · · · · · · · · · · · · · · · ·		
thermomagnetic, ph	notoelectric and optical properties of intrinsic and doped semiconductors is explained in detail with respect to possibilities of their effective Considerable attention is also paid to explanation of the properties of P-N junction and metal-semiconductor contact.	modification and o	ptimization.		
11PPOL	Practical Training of Semiconductors	KZ	4		
	tical training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of bas materials and devices.		niconductor		
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 de		_		
11PSPL	Practical Exercises from Solid State Structure Analysis	KZ	4		
The aim of this p	ractical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of structure de	pendant properties	of solids.		
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	Z used solutions.	3		
11SAE1	Seminar and Excursions 1	7	5		
The subje	ct is recommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduates	and undergraduat	es		
11SAE2	Seminar and Excursions 2	Z	5		
Excursions of stude	ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students		of students		
11SAE3	Seminar and Excursions 3	Z	5		
Excursions of stude	ints to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students		of students		
11SAE4	Seminar and Excursions 4	7	5		
_	ents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and	active participation	_		
440514	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 are is to familiarize students with the work on scanning electron microscope (SEM) and the possibilities of bundle analytical methods a	ZK	2		
	il 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 ma	-			
-	available experimental techniques.	_			
11SIK	Computer Simulation of Condensed Matter	Z,ZK	5		
Computer simulation	in in condensed-matter physics is becoming an important tool used by both experimentalist and theorists to develop new materials ar	nd technologies. Th	us, solution		
	roblems can be transferred from the real to a "virtual" laboratory. During the course, students will be introduced to the theoretical bac	_			
	est the acquired knowledge in practical exercises. Each lesson is organized as a tutorial where typical problems are solved with detailed	•	-		
methods used. The	course is taking place in Computer classroom of the Department of Solid State Physics. Practical demonstration and exercises are use environment (Accelrys Software Inc.).	sing Material Studi	o simulation		
11SIKL	Computer Simulation of Condensed Matter	ZK	4		
	on in condensed-matter physics is becoming an important tool used by both experimentalist and theorists to develop new materials are				
	roblems can be transferred from the real to a "virtual" laboratory. During the course, students will be introduced to the theoretical bac	-			
methods and let to t	est the acquired knowledge in practical exercises. Each lesson is organized as a tutorial where typical problems are solved with detailed	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 are used to be a solid State Physics.	sing Material Studi	o simulation		
44004004	environment (Accelrys Software Inc.).	71/	0		
11SMAM	Smart Materials and Their Applications e materials have one or more properties, such as shape, conductivity or color, that can be dramatically and reversibly altered by change	ZK	2 Leonditions		
	onding to external stimuli (heat, stress, electric field, light) influences what types of applications the smart material can be used for TI				
	Passive and active vibration damping, airbag sensors, acoustic transducers, precision positioners, miniature ultrasonic motors, vasc				
cellular phone ante	nnas, light sensitive glasses or photochromic and thermochromic clothes could serve as a few examples. Lectures are focused on phy	sical properties, e	xperimental		
	ation and possible application of color changing materials, light emitting materials, piezoelectric materials, conducting polymers, diel				
	shape-memory materials. Attention is also paid to the effect of phase transitions on physical properties of smart materials and to the				
11SMEX1	Seminar and Excursions 1	Z	4		
11SMEX2	ct is recommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduates				
_	Seminar and Excursions 2 ents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and	Z active participation	4 of students		
Excursions of stude	on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students		i oi students		
11SMEX3	Seminar and Excursions 3	Z	4		
	ents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and	active participation	of students		
	on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students	s theses.			
11SMEX4	Seminar and Excursions 4	Z	4		
Excursions of stude	ents to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students		of students		
11STPL	Seminar in Solid State Theory	KZ	2		
11017	The purpose of this lecture is to solve numerical problems of theory of solids and physics of condensed state.	114	_		
11SUPR	Superconductivity and Low Temperature	ZK	4		
	rse is: low temperature physics, including cooling methods, low temperature technique, and measurement of low temperatures; macr		_		
in quantum fluids (superfluidity and superconductivity), quantum crystals and diffusion, mesoscopic phenomena in electron systems, quantum Hall effects, Coulomb blockade and single electron transistor.					
11TPL1	Solid State Theory 1	ZK	6		
	n solids. Symmetry of crystalline solids. Vibrations of crystalline lattice and its thermal properties. Band electron structure of crystallin		_		
	electrons in nonideal solids.				

11TPL2	Solid State Theory 2	ZK	3			
Electric, magnetic and thermal properties of itinerant electrons in solids, Bolzmann kinetic equation, transport and optical phenomena in solids						
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 propagation (and its interaction 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 focuses on the structure of solids from the point of view of the arrangement of atoms. The first part focuses on application-interesting structures from metallic materials						
to molecular crystals. 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 average and the local structure.						
Objective of the course is also the use of special programs designed to study and analyze the structure and microstructure of 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 spectrum. Sources of electromagnetic radiation. Radiometric and photometric units. Ideal detector. External and internal photoefect. Quantum fluctuations of radiation.						
Noise of detector and electronic circuits. Dynamic range. Detectors based on external photoefect. Photocathodes. Electron multipliers. Microchannel plates. Image intensifiers. Detectors						
based on internal photoefect. Semiconductor detectors. Scintilators. Detectors of IR, VIS and UV radiation. X-ray detectors Pyroelectricity and pyrodetectors. Detector electronic						
circuits. Human eye.						
12FOPT	Optical Physics	Z,ZK	3			

12KOP Quantum Optics

The lecture covers the advanced topics in quantum optics, consequentially to the previous course of Quantum electronics. It systematically discusses especially the statistical properties of radiation, coherent states of electromagnetic field, quantum description of optical radiation, special states of fields, with respect to quasi-probability densities and characteristic functions. Next, the attention is given both to Dirac quantum theory of interaction of quantized electromagnetic field with a quantum system (including spontaneous emission) and quantum theory of scattering (Rayleigh, Thomson, Raman, resonance fluorescence). The attention is further given both to the quantum theory of coherence (quantum theory of detection, quantum correlation functions), in relation to classical theory. The course is further devoted to generalized higher-order coherence theory, coherent properties of special states of fields, and quantum theory of damping (quantum damped harmonic oscillator, Heisenberg-Langevin approach). Finally, the attention is given to review of nonclassical measuring techniques (photocounting, intensity interferometry, Brown-Twiss effect, stellar correlation interferometer, correlation spectroscopy), possibilities of measuring the quantum state of light, and some selected parts of modern quantum optics (squeezed states). The lectures are accompanied with practical example exercises.

The lecture covers the basics of optical physics. It systematically discusses the optical wave propagation in vacuum, in isotropic and anisotropic media, and on their boundaries. It also classifies types of optical waves. Next, it describes the polarization and its applications, statistical properties of polychromatic waves, fundamentals of two and multiwave interference.

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