Study plan

Name of study plan: Doctoral studies, structured combined studies

Faculty/Institute/Others:

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch: Program of study: Welcome page Type of study: unknown combined

Required credits: 30

Elective courses credits: 20 Sum of credits in the plan: 50

Note on the plan: ~Studijní plán je ur en školitelem pro každého doktoranda individuáln .\\

Name of the block: Compulsory elective courses

Minimal number of credits of the block: 30

The role of the block: S

Code of the group: XPKKPPP

Name of the group: Doctoral subjects XPkkppp

Requirement credits in the group: In this group you have to gain at least 30 credits (at most 50)

Requirement courses in the group:

Credits in the group: 30 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
XP02AMA	Active Methods in Acoustics Ond ej Jií ek Ond ej Jií ek Ond ej Jií ek (Gar.)	ZK	4	2P	L	S
XP37AEM	Acoustic and Electroacoustic Measurements Libor Husník Libor Husník (Gar.)	Z,ZK	4	2P+1S	L	S
XP37APF	Acoustics and Electroacoustics of Solid State Libor Husník	Z,ZK	4	3P+1L	Z	S
XP37AR	Speech Acoustics	ZK	4	2+0s	L	S
XP31ASN	Algorithms and Structures of Neurocomputers	ZK	4	2P+2S	L	S
XP31AEO	Electric Circuit Analysis	ZK	4	2P+2S	Z	S
XP04A2SZK	English Language	ZK	0		Z,L	S
XP04AZK	English Language Petra Juna Jennings, Markéta Havlí ková Petra Juna Jennings Petra Juna Jennings (Gar.)	ZK	0	0C	Z,L	S
XP04MIN	English Language 2 Petra Juna Jennings, Markéta Havlí ková, Dana Saláková Petra Juna Jennings Petra Juna Jennings (Gar.)	ZK	0	0C	Z,L	S
XP04A1ZK	English language 1	ZK	0		Z,L	S
XP04A1	English language 1 Petra Juna Jennings Petra Juna Jennings (Gar.)	NIC		4C	Z,L	S
XP04A2ZK	English language 2	ZK	0		Z,L	S
XP04A2	English language 2 Petra Juna Jennings Petra Juna Jennings (Gar.)	NIC		4C	Z,L	S
XP34AT	TCAD Tools Applications Jan Voves Jan Voves Jan Voves (Gar.)	ZK	4	2P+2C	L	S
XP32AKR	Applied Cryptography Tomáš Van k Tomáš Van k Tomáš Van k (Gar.)	ZK	4	4P + 0S	L	S
XP17APL	Applied Optoelectronics in Medicine Jan Vrba	ZK	4	2P+2C	Z	S
XP36ASP	Architecture of Symbolic Computers Josef Kolá Josef Kolá Neur en (Gar.)	ZK	4	2P+2S	L	S
XP37ARA	Architectural Acoustics Libor Husník Libor Husník (Gar.)	ZK	4	2P+2S	L	S
XP31ART	Architectures for Real Time Implementation	ZK	4	2P+2S	L	S

XP33BID	Bionics	ZK	4	2P+2S	Z	S
XEP35CMS	Computational Methods for Materials Science	Z,ZK	4	2P+2C	Z,L	S
XP04 1	Antonio Cammarata Antonio Cammarata Antonio Cammarata (Gar.) Czech language 1 Dana Saláková	NIC	0	4C	Z,L	S
XP04C1ZK	Czech language 1	ZK	0		Z,L	S
XP04C2ZK	Markéta Havlí ková Czech language 2	ZK	0		L,Z	S
	Markéta Havlí ková Czech language 2					
XP04 2	Dana Saláková	NIC	0	4C	Z,L	S
XP31DSP	Digital signal processing Pavel Sovka	ZK	4	2P+2S	Z	S
XP36RGM	Reading group in data mining and machine learning Ji í Kléma, Filip Železný Filip Železný Ji í Kléma (Gar.)	ZK	4	2P	Z,L	S
XP13DFD	Data and Functional Analysis of Production Systems Martin Molhanec	Z,ZK	4	2P+2S	L	S
XP34ORD	Optical Radiation Detection and Detectors Václav Prajzler, Vít zslav Je ábek Václav Prajzler Václav Prajzler (Gar.)	ZK	4	2P+2C	L	S
XP36DRO	Diagnostics and Reconfiguration of Programmable Circuits	ZK	4	2P+2S	Z	S
XP15DVN	Diagnostics of HV and EHV Insulating Systems	Z,ZK	4	2P+2S	L	S
XP02DP	Electric Discharges and their Applications	ZK	4	2P+2C	L	s
XP32DZS	Pavel Kubeš, Karel ezá Karel ezá Pavel Kubeš (Gar.) Digital Signal Procesing in Telecommunications	ZK	4	4P + 0S	L	S
XP33DID		ZK	4	2P+1S	Z	S
XP36DSY	Distributed Artificial Intelligence	ZK	4	2P	Z	S
XP37DRS	Distributed Systems Satellite communication and navigation systems	Z,ZK	4	2+2s	 	S
	František Vejražka Dynamics of Electric Machines	-				
XP14DES	Miroslav Chomát Miroslav Chomát Miroslav Chomát (Gar.)	ZK	4	2P+2C	Z	S
XP16ERU	Accounting	ZK	4	2P+2S	L	S
XP16EKO	Economics	ZK	4	2P+2S	Z	S
XP16MES	Economics and Management of Energy Systems	ZK	4	2P+2S	L	S
XP16EME	Economics and Management of Energetics	ZK	4	2P+2S	Z	S
XP16MEU	Economics and Management of Energetics	ZK	4	2P+2S	Z	S
XP37ELA	Elastoacoustics	ZK	4	2+0s	L	S
XP15ES	Electrical Lighting	Z,ZK	4	2P+2S	L	S
XP15ET	Electroheat Jan Kyncl Jan Kyncl (Gar.)	Z,ZK	4	2P+2S	L	S
XP02EVA	Physics for Electroenergetics Pavel Kubeš Pavel Kubeš Pavel Kubeš (Gar.)	ZK	4	3P	Z	S
XP34ETS	Electrical Transport in Semiconductors Jan Voves Jan Voves Jan Voves (Gar.)	ZK	4	2P+2C	Z	S
XP17ELD	Electrodynamics	ZK	4	2P+2C	Z	S
XP14EMC	Electromagnetic Compatibility Zden k e ovský Zden k e ovský (Gar.)	ZK	4	2P+2C	Z	S
XP38EMC	Electromagnetic Compatibility of Data Acquisition Systems Jan Holub Jan Holub Jan Holub (Gar.)	ZK	4	2P+2C	Z	S
XP15EH	Energy Economy	Z,ZK	4	2P+2S	L	S
XP15EZP	Zden k Müller Control in Power Engineering	Z,ZK	4	2P+2S	L	S
XP33ECD	Ivo Doležel Evolutionary Computing	ZK	4	2P+1S	Z	S
XP15EXE	Expert Systems in Electrical Power Engineering	Z,ZK	4	2P+2S	Z,L	S
XP16FVT	Philosophical Problems of Science and Technology	ZK	2	0P+4S	L,Z	S
XP16FIM	Financial Management	ZK	4	2P+2S		s
XP31FSK	Phonetic signals and their coding	ZK	4	2P+2S	L	S
XP15FAK	Photometry and Colorimetry	Z,ZK	4	2P+2S	L	S
XP37FOS	Photonic Imaging Systems	ZK	4	2P+2L+4D	Z	S
XP13FCD	Petr Páta Petr Páta Petr Páta (Gar.) Photovoltaics systems	Z,ZK	4	2P+2L	 L	S
XP04F1ZK	Jakub Holovský, Vít zslav Benda Vít zslav Benda Vít zslav Benda (Gar.)	ZK	0	∠ı ⊤∠L	Z,L	S
XP04F1	French language 1	NIC		4C	Z,L	S
AT UTI I	French language 1	INIC	0	1-0	Z,L	3

XP04F2	French language 2	NIC		4C	L,Z	s
XP01FA1	Functional Analysis 1	ZK	4	2P+2S	L	s
XEP33FLO	Jan Hamhalter Jan Hamhalter Jan Hamhalter (Gar.) Fuzzy Logic	ZK	4	2P+0S	L	S
XP33FLO	Mirko Navara Mirko Navara Mirko Navara (Gar.) Fuzzy Logic	ZK	4	2P+0S	L	S
XP35FMD	Mirko Navara	ZK	4	2P+2C	L	s
XP37FZS	Fuzzy Modelling and Control	Z,ZK	4	2+2s	L	S
XP13FDD	Fuzzy Signal Processing Physic of Dielectrics	•	<u> </u>	2P+2S		
XP13FDD	Pavel Mach Pavel Mach (Gar.)	Z,ZK	4	2P+25	Z	S
XP02FPL	Solid State Physics Antonio Cammarata Antonio Cammarata Antonio Cammarata (Gar.)	ZK	4	2P+2C	L	s
XP13FPD	Semiconductor Physics Vít zslav Benda Vít zslav Benda (Gar.)	Z,ZK	4	2P+2S	Z	s
XP37FHA	Physiological, Psychological and Musical Acoustics	ZK	4	2+2s	L	S
XP37FHA1	Physiological, Pychologycal and Musical Acoustics 1	ZK	4	2P+0S	Z	S
XP37GAB	Genesis and Analysis of Biosignals	ZK	4	3P+1S	L	S
XP33GAD	Geometrical Algebras	ZK	4	2+0s	L	S
XP02HS	Noise Surveys Ond ej Ji í ek	ZK	4	1P	L	S
XP36HS	Hypermedia Systems and Internet Computing Ivan Jelínek Ivan Jelínek Ivan Jelínek (Gar.)	ZK	4	2P+2S	L	s
XP33IMD	Informatics in Clinical Medicine	ZK	4	2P+0S	L	S
XP01ITZ	Integral Transforms and Z Transform	ZK	4	2+1	Z	S
XP34IO	Integrated Optics Václav Prajzler, Vít zslav Je ábek, David Mareš Vít zslav Je ábek Vít zslav	ZK	4	2P+2C	Z	S
XP12IMM	Je ábek (Gar.) Engineering Methods in Mechanics	Z,ZK	4	2+2s	L	S
XP36JAI	Languages for Artificial Intelligence Josef Kolá	ZK	4	2P+2S	Z	S
XP01KAS	Complexity and Combinatorical Algorithms Marie Demlová	ZK	4	2+1	L	S
XP36KP	Communication Protocols	ZK	4	2P	L	S
XP34CNO	Integrated Optics Vít zslav Je ábek, Ji í tyroký Ji í tyroký (Gar.)	ZK	4	2P+2C	Z,L	S
XP16KVM	Quantitative Research Methods in Management	ZK	4	2P+2S	L	S
XP01KVP	Quantum Computing	ZK	4	2+2	Z	S
XP17LAE	Medical Applications of Electromagnetic Field Jan Vrba Jan Vrba (Gar.)	ZK	4	2P+2C	L	S
XP37LN	Aircraft Navigation František Vejražka František Vejražka (Gar.)	ZK	4	2P+2S	L	s
XP35LMI	Linear Matrix Inequalities	ZK	4	2P+2C	L	S
XP35LSD	Linear Systems	ZK	4	2P+2C	L	s
XP36LSM	Logical Simulation	ZK	4	2P+2S	Z	S
XP33LPD	Logic and Logic Programming	ZK	4	2P+2S	L	S
XP38MPX	Magnetism in Engineering Practice Pavel Ripka Pavel Ripka Pavel Ripka (Gar.)	ZK	4	2P+2C	Z	S
XP02MHD	Magnetohydrodynamics Pavel Kubeš Pavel Kubeš (Gar.)	ZK	4	2P	Z	s
XP16MAN	Management	ZK	4	2P+2S	L	S
XP16MAV	Production Management	ZK	4	2P+2S	L	S
XP16MAU	Accounting for management	ZK	4	2P+2S	L	S
XP16MAR	Marketing	ZK	4	2P+2S	Z	S
XP16MAS	Marketing Strategies	ZK	4	0P+4S	Z	S
XP01MST	Mathematical Statistics	ZK	4	2+1	L	S
XP01MTS	Mathematical Methods in Signal Theory	ZK	4	2+1	Z	S
XP01MKR	Mathematics for cryptography	ZK	4	2+1	Z	S
XP33MKD	Mathematics for Cybernetics - Selected Topics	ZK	4	2P+2S	L	S
XP01MTP	Matrix Calculus	ZK	4	2P+1S	L	S
XP15MPE	Mechatronics in Electrical Power Engineering	Z,ZK	4	2P+2S	L	S
XP38MMN	Measurement of Nonelectric Quantities Pavel Ripka Pavel Ripka Pavel Ripka (Gar.)	ZK	4	2P+2L	L	S

XP15MVN	High Voltage Measurement	Z,ZK	4	2P+2S	L	S
XP17MVP	Methodology of Science	ZK		2P+2C	Z	S
XP37MVP	Stanislav Vítek Stanislav Vítek (Gar.) Scientific Work Methodology	ZK	4	4P+0S	Z	S
XP17MAPP	Stanislav Vítek Miloš Klíma Analysis Methods for Passive Elements of Microwave and Millimeter-wave Technique Jan Machá , Vít zslav Pankrác Jan Machá Jan Machá (Gar.)	ZK	4	2P+2C	Z	S
XP38MDR	Methods of Signals Digitalization and Reconstruction	ZK	4	2P+2C	L	S
XP38MPM	Josef Vedral Josef Vedral Josef Vedral (Gar.) Methods for Precision Measurement of Electrical Quantities	ZK	4	2P+2C		S
XP14MIR	and Measurement Data Processing Microprocessor Control of Electric Drives	ZK	3	4+0s	Z,L	S
XP34MSY	Microsystems	ZK ZK	4	2P+2C	Z,L	S
	Miroslav Husák Miroslav Husák Miroslav Husák (Gar.) Microwave Technique		1			
XP17MT	Jan Vrba, Karel Hoffmann Jan Vrba Karel Hoffmann (Gar.)	ZK	4	2P+2C	Z	S
XP32MOS	Mobile Networks Pavel Mach, Zden k Be vá, Robert Bešák Zden k Be vá Zden k Be vá (Gar.)	ZK	4	2P + 2C	Z	S
XP33MOL	Modal Logics for Distributed Systems	ZK	4	2P+0S	Z	S
XP13MSD	Modelling and Simulation of Technological Systems Pavel Mach Pavel Mach (Gar.)	Z,ZK	4	2P+2C	Z	s
XP33ICT	Modern ICT for Industry and Smart Grids	ZK	4	2P+0S	L	S
XP14MRP	Advanced Controlled Drives	ZK	3	4+0s	Z	S
XP37MSC	CNS Modern Systems	ZK	4	2+2s	Z,L	S
XP34APD	Advanced Power Semiconductor Devices and ICs Jan Vobecký Jan Vobecký Jan Vobecký (Gar.)	ZK	4	2P+2C	Z,L	S
XP14MZR	New Control Methods for Electric Drives Ji í Lettl Ji í Lettl (Gar.)	ZK	4	2P+2C	Z	S
XP37MPS	Multimedia Signals Transmission Václav Žalud Václav Žalud	ZK	4	2P+2S	Z	S
XP31NOS	Design and circuit structures of electronic systems Ji í Hospodka Ji í Hospodka (Gar.)	ZK	4	2P+2S	L	S
XP31DIF	Digital filter synthesis Pavel Sovka	ZK	4	2P+2S	Z	S
XP34PIC	Programmable IC Design Pavel Hazdra Pavel Hazdra (Gar.)	ZK	4	2P+2C	Z	S
XP37NRO	CAD for RF and Microwave Circuits Josef Dobeš Josef Dobeš Josef Dobeš (Gar.)	Z,ZK	4	3P+1S	Z	S
XP35NES	Nonlinear Systems	ZK	4	2P+2C	L	S
XP04N1	German language 1	NIC		4C	Z,L	S
XP04N1ZK	German language 1	ZK	0		Z,L	S
XP04N2	German language 2	NIC		4C	Z,L	S
XP04N2ZK	German language 2	ZK	0		Z,L	S
XP36NSN	Neural Networks and Neurocomputers	ZK	4	2P+2S	Z	S
XEP33NEP	Neuroprosthetics	Z,ZK	4	2P+0S	Z	S
XP14MEN	New Trends in Converter Technology Zden k e ovský, Ji í Lettl Ji í Lettl Ji í Lettl (Gar.)	ZK	4	2P+2C	L,Z	S
XP14APR	New Trends in Electric Device Apply	ZK	3	4+0s	L	S
XP14TPR	New Trends in Electric Device Theory	ZK	3	4+0s	Z	S
XEP33NUM	Numerical Analysis Mirko Navara	Z,ZK	4	2P+2S	L	S
XP33NUM	Numerical Analysis Mirko Navara	Z,ZK	4	2P+2S	L	S
XP01NLA	Numerical Linear Algebra	ZK	4	2P+1S	L	S
XP32NMR	Numerical Methodes of Electromagnetic Tasks Solution	ZK	4	4P + 0S	L	S
XP17NME	Numerical Methods in Electromagnetic Field Jan Machá Jan Machá Jan Machá (Gar.)	ZK	4	2P+2C	L	S
XP35OFD	Estimation and Filtering	ZK	4	2P+2C	Z	S
XP37ODS	Optical Design and Simulation	ZK	4	2P+2C		S
XP17OV	Optical Fibers Stanislav Zvánovec Stanislav Zvánovec (Gar.)	ZK	4	2P+2C	L	S
XP36PSV	Parallel Systems and Algorithms	ZK	4	3P+2S	L	S
XP01PDR	Partial Differential Equations	ZK	4	3P+0S	L	S
XP34PED	Advanced Electronic Devices	ZK	4	2P+2C	Z	S

XP13PED	Plastics in Electrical Engineering Ivan Kudlá ek Ivan Kudlá ek Ivan Kudlá ek (Gar.)	Z,ZK	4	2P+2S	Z	S
XP02PT	Plasma Technologies	ZK	4	2P	L	S
XEP36AGT	Advanced Computational Game Theory Branislav Bošanský, Viliam Lisý Branislav Bošanský (Gar.)	ZK	4	2P+0C+4D		S
XP39PMV	Advanced Methods of Visualization Pavel Slavík Pavel Slavík (Gar.)	ZK	4	2P+2S	Z	S
XP36POA	Advanced Parallel Algorithms	ZK	4	2P+2S	Z	s
XP34SRS	Semiconductor Radiation Sources Vít zslav Je ábek, Zden k Burian Vít zslav Je ábek Vít zslav Je ábek (Gar.)	ZK	4	2P+2C	L,Z	S
XEP33SAM	Understanding State of the Art Methods, Algorithms, and Implementations	ZK	4	2P+2S	L	S
XP33PPD	Practical Data Mining Problems	ZK	4	2P+2S	L	S
XP33PAD	Probabilistic Algorithms	ZK	2	2P+0S	L	S
XP33PMD	Probabilistic Models of Uncertainty in Al	ZK	4	2P+0S	L	S
XP37PKP	Biomedical Engineering in Clinical Practice	ZK	4	2P+0S	L	S
XP36PAS	Algebraic Specifications Prototyping Karel Richta Karel Richta Karel Richta (Gar.)	ZK	4	2P+2S	Z,L	S
XP33PAM	Industrial application of multi-agent systems	ZK	4	1P+0S	L	S
XP13PSD	Flexible Production Systems	Z,ZK	4	2P+2S	Z	S
XP15PEE	Transmission of Electricity Zden k Müller Zden k Müller	Z,ZK	4	2P+2S	L	S
XP38PSL	Aircraft Instrumentation Jan Rohá Jan Rohá Jan Rohá (Gar.)	ZK	4	2P+2L	Z	S
XP38PUC		ZK	2		L	S
XP37RAD	Radioelectronics Pavel Ková Pavel Ková Pavel Ková (Gar.)	ZK	4	2P+2S	L	S
XP36RSY	Reconfigurable Systems	ZK	4	2P+2S	L	S
XP35RRD	Robust Control	ZK	4	2P+2C	Z	S
XP33RSK	Robust Statistics for Cybernetics Jana Nosková Jana Nosková Jana Nosková (Gar.)	ZK	4	2P+0S	L	S
XP33ROD	Pattern Recognition	ZK	4	2P+2S	L	S
XP04R1ZK	Russian language 1	ZK	0		L,Z	S
XP04R1	Russian language 1	NIC		4C	Z,L	S
XP04R2	Russian Language 2	NIC		4C	Z,L	S
XP04R2ZK	Russian language 2	ZK	0		Z,L	S
XP16JAK	Quality Management	ZK	4	2P+2S	Z	S
XP33RMD	Control of Mobile Robots	ZK	4	2P+2S	L	S
XP35CCM	Cooperative Control of Multi-agent systems	ZK	4	2P+2C		S
XP32RTS	Telecommunications Systems Management	ZK	4	2P + 2C	Z	S
XP15RE	Control of Power Systems Zden k Müller Zden k Müller Zden k Müller (Gar.)	Z,ZK	4	2P+2S	Z,L	s
XEP17SWR	Scientific Writing	ZK	4	2P+2S	*	S
XP15SPS	Coupled Problems in Heavy Current and Power Engineering Ivo Doležel	Z,ZK	4	2P+2S	Z	s
XEP33VKR	Selected Topics in Pattern Recognition and Computer Vision Mirko Navara	ZK	4	2P+2S	Z	s
XP01SPJ	Syntax and semantics of a formal language	ZK	4	2+1	Z	s
XP39SPG	Computer Graphics Seminar Ji í Bittner, Daniel Sýkora Daniel Sýkora Ji í Bittner (Gar.)	Z,ZK	4	2P+2S	L	S
XP36SEP	Seminars on Architectures of Parallel Computers	ZK	4	2P	L	s
XP38SSB	Sensors and Buses Antonín Platil Antonín Platil (Gar.)	ZK	4	2P+2L	Z,L	S
XP13SID	Software in Industrial Engineering Martin Molhanec Martin Molhanec (Gar.)	Z,ZK	4	2P+2C	Z	S
XP13SSD	Special Methods of Devices Quality Evaluation Václav Papež Václav Papež Václav Papež (Gar.)	Z,ZK	4	2P+2L	Z	S
XP37SRP	Radio Receivers Special Technology Václav Žalud Václav Žalud Václav Žalud (Gar.)	ZK	4	2P+2S	Z	S
XP02SF	Statistical Physics Petr Kulhánek, Antonín Krpenský Antonín Krpenský Petr Kulhánek (Gar.)	Z,ZK	4	3P+1S	L	S
XP37SZS	Statistical Signal Processing Pavel Sovka, Jan Sýkora Jan Sýkora (Gar.)	Z,ZK	4	4P+0S	L	s

XP16STV	Product Strategy	ZK	4	0P+4S	L	S
XP36STR	Stringology	ZK	4	2P+2S	Z,L	s
XEP33SML	Structured Model Learning Vojt ch Franc Vojt ch Franc (Gar.)	ZK	4	2P+1S	L	S
XP34STV	VLSI Structures and Technologies Ji í Jakovenko Ji í Jakovenko (Gar.)	ZK	4	2P+2C	Z	S
XP15ZSS	Light sources and Equipment	Z,ZK	4	2P+2S	L	S
XP33SCD	Man-Machine Systems	ZK	4	2P+1S	Z	s
XP38SYS	Measurement and Data Acquisition Systems	ZK	4	2P+2L	Z,L	S
XP13SRD	Real Time Systems for Process Control Martin Molhanec	Z,ZK	4	2P+2C	L	S
XP13SJD	Quality Control Systems Pavel Mach, Martin Molhanec Pavel Mach Pavel Mach (Gar.)	Z,ZK	4	2P+2S	L	s
XP04S1ZK	Spanish language 1	ZK	0		Z,L	S
XP04S1	Spanish language 1	NIC	0	4C	Z,L	S
XP04S2ZK	Spanish language 2	ZK	0		Z,L	S
XP04S2	Spanish language 2	NIC	0	4C	Z,L	S
XP37TMP	Medical Instrumentation	ZK	4	2+2s	L	S
XP13TND	Technology of Low Temperatures and Superconductivity	Z,ZK	4	2P+2S	L	S
XP17TVC	Technique of Highly Sensitive Receivers Miloš Mazánek, Jan Kra ek Miloš Mazánek Miloš Mazánek (Gar.)	ZK	4	2P+2C	L	S
XP13TMD	Technological Aspects of Microcomputer Design	Z,ZK	4	2P+2S	Z	S
XP13TPD	Technological Processes in Electronic Manufacturing Pavel Mach, Karel Dušek Karel Dušek Karel Dušek (Gar.)	Z,ZK	4	2P+2L	L	S
XP34TOS	Technology of Optical Devices Václav Prajzler, Vít zslav Je ábek Václav Prajzler Václav Prajzler (Gar.)	ZK	4	2P+2C	Z,L	S
XP37TEA	Theoretical Eletroacoustics Libor Husník, Zden k Škvor Libor Husník Libor Husník (Gar.)	Z,ZK	4	3P+1S	Z	S
XP02TF1	Theoretical Physics 1 Petr Kulhánek, Antonín Krpenský Petr Kulhánek Petr Kulhánek (Gar.)	Z,ZK	4	3P+1C	Z	S
XP02TF2	Theoretical Physics 2 Antonín Krpenský Antonín Krpenský (Gar.)	Z,ZK	4	3P+1C	L	S
XP37TAS	Acoustic signal processing and theory František Rund, Václav Vencovský, František Kadlec Václav Vencovský František Rund (Gar.)	Z,ZK	4	2P+2L	Z	S
XP01TGR	Graph Theory Marie Demlová Marie Demlová (Gar.)	ZK	4	2P+1S	Z	S
XP01TJA	Languages, Automata and Grammars Marie Demlová	ZK	4	2P+1S	L	s
XP15TOS	Theory of Light field	Z,ZK	4	2P+2S	L	S
XP32TPZ	Teletraffic Theory	ZK	4	3P + 0S	L	S
XP31TSS	Signal and system theory Pavel Sovka	ZK	4	2P+2S	L	S
XP02TZP	Theory of Sound Field Ond ej Ji í ek, Milan ervenka Ond ej Ji í ek Ond ej Ji í ek (Gar.)	ZK	4	2P	Z	s
XP17TAM	Evaluation of Applicators for Microwave Thermotherapy Jan Vrba Jan Vrba (Gar.)	ZK	4	2P+2C	Z	S
XP33TTM	Text mining	ZK	4	2P+0S	Z	S
XP02UZ	Ultrasound and Quantum Acoustics Rudolf Bálek Rudolf Bálek (Gar.)	ZK	4	2P	Z	S
XP33UID	Artificial Intelligence	ZK	4	2P+1S	Z	S
XP01UAG	Introduction to Algebraic Geometry	ZK	4	2+1	L	S
XP02UFL	Introduction to Laser Physics Jan Píchal Jan Píchal (Gar.)	ZK	4	2P	L	s
XP01UNA	An introduction to nonassociative algebras	ZK	4	2+1	Z	S
XP01USA	An introduction to superalgebras.	ZK	4	2+1	L	S
XP15UEE	Electric Energy Use and Conservation	Z,ZK	4	2P+2S	Z,L	S
XP13VTK	Vacuum technology and cryogenics	Z,ZK	4	2P+2S	Z	S
XP37VRA	Research Seminars in Radioelectronics and Acoustics Jan Sýkora	Z,ZK	4	1P+1S	Z,L	S
XP39VR	Virtual reality David Sedlá ek, Ji í Žára David Sedlá ek Ji í Žára (Gar.)	ZK	4	2P+2S	L	S
XP02VNP	Plasma Waves and Instabilities Petr Kulhánek, Antonín Krpenský Petr Kulhánek Petr Kulhánek (Gar.)	Z,ZK	4	3P+1C	Z	S
XP16DEL	History of technology and economic Marcela Efmertová, Jan Mikeš Marcela Efmertová (Gar.)	ZK	2	0P+4S	L	S

XP37VKF	Selected Parts from Photonics Miloš Klíma Miloš Klíma Miloš Klíma (Gar.)	ZK	4	4P+0S	L	S
XP38VKP	Selected Parts of Instrumentation Jan Holub Jan Holub Jan Holub (Gar.)	ZK	4	2P+2L	Z,L	S
XP01TEM	Selected chapters of the measure theory	ZK	4	2+1	L	S
XP33KSI	Sotware Engineering - Selected chapters	ZK	4	2P+0S	L	S
XP38VKZ	Selected Chapters of Signal Processing Jan Holub Jan Holub	ZK	4	2P+2C	L	S
XP38VDI	Selected Chapters of Diagnostics Radislav Šmíd Radislav Šmíd	ZK	4	2P+2C	L	S
XP36VPD	Selected Parts of Data Mining Ji í Kléma	ZK	4	2P+2S		S
XP01VPS	Selected topics in probability and mathematical statistics Kate ina Helisová Kate ina Helisová (Gar.)	ZK	4	2P+1S	*	S
XP33PUD	Artificial Intelligence	ZK	4	2P+2S	Z	S
XP17ANS	Selected Chapters from Antennas and Propagation Miloš Mazánek, Jan Kra ek Miloš Mazánek Miloš Mazánek (Gar.)	ZK	4	2P+2C	L	S
XP02VPA1	Selected Topics of Physics 1 Viktor Hruška, Petr Koní ek Petr Koní ek Viktor Hruška (Gar.)	ZK	4	2P	Z	S
XP02VPA2	Selected Topics of Physics B Viktor Hruška Viktor Hruška Viktor Hruška (Gar.)	ZK	4	2P	L	S
XP02VPB	Selected Topics of Physics B Viktor Hruška Viktor Hruška (Gar.)	Z,ZK	4	2+2s	L	S
XP02VPO	Selected Topics of Optics Antonín Krpenský, Josef Kravárik Josef Kravárik (Gar.)	Z,ZK	4	2P+2S	Z	S
XP33ROZ	Selected Topics in Pattern Recognition	ZK	4	2P+2S	L	S
XP16MVE	Selected Problems of Economy and Management of Energy	ZK	4	2P+2S	L	S
XP37SFA	Fundamentals of Physical Acoustics	ZK	4	1+0s	L	S
XP16STM	Selected Statistical Methods Šerzod Tašpulatov Šerzod Tašpulatov (Gar.)	ZK	4	2P+2S	L,Z	S
XP39VPG	Computational Geometry Petr Felkel Petr Felkel (Gar.)	ZK	4	2P+2S	Z	S
XP36VAP	Advaced Computer Architecture	ZK	4	2P+2S	Z	S
XP12VVM	Development and Research of Materials	Z,ZK	5	3+2s	L,Z	S
XP15VME	Research Methods in th Use of Electrical Energy Jan Kyncl, Ivo Doležel Ivo Doležel (Gar.)	Z,ZK	4	2P+2S	L	S
XP02ZFP	Fundamentals of the Plasma Physics Stanislav Pekárek Stanislav Pekárek (Gar.)	ZK	4	3P	Z	S
XP33ZPM		ZK	4	1P+1S	L	S
XP33ZVD	Introduction to Computer Vision	ZK	4	2P+2S	Z	S
XP01ZWT	Wavetet Transform. Jan Hamhalter	ZK	4	2P+1S	L	S
XP37ZI	Information recording František Kadlec	Z,ZK	4	2P+2S	L	S
XP31ZBS	Biological Signal Processing Roman mejla, Jan Rusz, Radek Jan a, Jan Sedlák, Petr Ježdík Pavel Sovka Roman mejla (Gar.)	ZK	4	2P+2C	Z	S
XP37ZSN1	Signal processing in satellite navigation systems 1 František Vejražka František Vejražka (Gar.)	Z,ZK	4	1P+3S	Z	S
XP37ZSN2	Signal processing in satellite navigation systems 2 František Vejražka František Vejražka (Gar.)	Z,ZK	4	1P+3L	L	S
XP33VID	3D Computer Vision Radim Šára Radim Šára	ZK	4	2P+2S	Z	S

Characteristics of the courses of this group of Study Plan: Code-YPKKPPP Name-Doctoral subjects YPkknnn

Characteristics of	the courses of this group of Study Plan: Code=XPKKPPP Name=Doctoral subjects XPKK	рр	
XP02AMA	Active Methods in Acoustics	ZK	4
Physical principles, inte	frierence, Huygens principle, sound field in ducts, vawe-guides and enclosures. Active noise control in a duct. One or more s	econdary sources	. Active control
in enclosures, acoustic	coupling, modes, local control. Feedback and feedforward strategy, analog adn digital realisations, algorithms based on LMS, s	stability of algorithr	ns, multichannel
algorithms. Practical rea	alisations of active systems. Active control of vibrations, transducers for active control.		
XP37AEM	Acoustic and Electroacoustic Measurements	Z,ZK	4
Measurement of acoust	ic pressure, measuring microphones. Measurement of acoustic impedance. Foundamental audiometric measurements, artifi	cial ear. Measurer	nent of acoustic
power. Methods of calib	ration of measuring microphones. Method of reciprocity. Method of reciprocity in the field of the spherical wave, in the diffusic	n sound field. Cali	bration methods
for accelerometers and	sensors of velocity and displacement. Measurement of mechanical impedance, impedance head, artificial mastoid. Electrosi	atic transducer an	d its application
for electroacoustic mea	surements. Measurement of thin membranes and air-gaps. Acoustic intensity measurement. Measurements of acoustic trans	smitters.	
XP37APF	Acoustics and Electroacoustics of Solid State	Z,ZK	4
	'		

Waves in elastic isoptropic unbounded continuum. Wave equation. Scalar and vector potential. Plane harmonic uniform and non-uniform wave. Energy and power in plane harmonic wave. Plane wave in half-space, reflection and refraction of a plane wave at an interface between too solids. P-wave, SV and SH waves. Rayleigh waves. Waves in wave -guides in solids. Wave propagation in cylindrical wave-guide. Solid-state waveguides of non-uniform cross-section. Piezoelectricity. Equivalent circuits of piezoelectric transducers for generation of volume and surface waves.

XP37AR Speech Acoustics ZK 4
Vocal tract, anatomy, physiology. Vocal cords, production of speech. Types of phonems. Speech analysis and synthesis. Automatic recognition of speech.

XP31ASN	Algorithms and Structures of Neurocomputers	ZK	4
	asic principles and possibility of the application of the neural informative technology for the signal processing are the main to artificial neural networks (ANN) theory and applications, to the choice and the optimisation of the structures and the neural	•	
	at thicker he did networks (Arthy) theory and applications, to the choice and the optimisation of the structures and the hedral ated in detail. Some neural network applications in the biomedical engineering and hardware realization of the KSOM are de		ons at the signal
XP31AEO	Electric Circuit Analysis	ZK	4
Circuit models of device	es and structures. Methods of analysis and algorithms for linearized circuit models in time domain and frequency domain. Tra	ı ansient analysis. Pe	eriodic steady
1	of nonlinear circuits in time and frequency domains. Parametric models. Circuits with non-linear energy storing elements. Circuits with non-linear energy storing elements. Circuits with non-linear energy storing elements.	rcuit analysis with	the help of
professional software pa			Υ
XP04A2SZK	English Language	ZK	0
XP04AZK	English Language	ZK	0
· · · · · · · · · · · · · · · · · · ·	nketa/aktualni/courses/XP04AZK	71/	0
XP04MIN	English Language 2 defense of professional study in English. The task of the doctoral student before the committee to defend his professional worl	ZK	0 optod in English
-	ent discussion. PhD student is evaluated in presentation skills , mastery of the language in continuous speech and language :	· · · · · · · · · · · · · · · · · · ·	_
'	ount is also the linguistic correctness of written text.		, , , , , ,
XP04A1ZK	English language 1	ZK	0
The subject A1 ZK is or	ly for those postgraduate students studying in older study program valid up to Sept.2003 and did not ask for studying langua	ages according to	the newer study
program .			
XP04A1	English language 1	NIC	
1	eral English from previous studies, further develops speaking skills, listening and recalling spoken English as well as note-tal	king skills. Provide	es basic scientific
XP04A2ZK	ct relationship, definitions, classification, basic information on composing written documents).	ZK	0
	English language 2 postgraduate students who study in older program valid up to Sept.2003 and did not ask for studying the new language pro	1	0
XP04A2	English language 2	NIC	
	ritten documents (papers, reports, articles, dissertations, official letters); oral presentations, reading skills (getting both gene	1	l nformation); the
	eech in a foreign language ; selected parts of difficult grammar; selected items focused on practical skills (reading mathemat		**
writing CV). Oral preser	atations.		
XP34AT	TCAD Tools Applications	ZK	4
	mputer-aided technological design. Device simulators Atlas and Sentaurus: principle, applications. Basic equations. Bounda		nerical methods.
	Avalanche ionisation models. Mobility models. Hands-on exercises on SUN workstations according to the tasks of students'	1	
XP32AKR	Applied Cryptography aphy.Mathematics Foundations of Cryptography.Related Problems of Number Theory.Public Key Parameters. Pseudorandor	ZK	4
	apriy.Mathematics Foundations of Cryptography.Related Froblems of Number Theory.Fublic Rey Farameters, Eseudorandor Public Key Enciphering. Hash Functions and Data Integrity. Entity Identification and Autentication.Digital Signatures. Key Manag	•	
1 '	plementations of Supporting Algorithms. Patent Pendings and Standards.	joinione i rotoccion	toy Managomont
XP17APL	Applied Optoelectronics in Medicine	ZK	4
		ZN	4
	invasive measurement techniques in medical diagnostics. Fundamental physiology of the vascular system, hemodynamics,	skin anatomy and	perfusion.
Computer simulation of	invasive measurement techniques in medical diagnostics. Fundamental physiology of the vascular system, hemodynamics, the cardiovascular system. UV, VIS and IR spectroscopy. Fundamental optics of the eye and color analysis. Optical paramet	skin anatomy and	perfusion.
Computer simulation of of light, Design of optical	invasive measurement techniques in medical diagnostics. Fundamental physiology of the vascular system, hemodynamics, the cardiovascular system. UV, VIS and IR spectroscopy. Fundamental optics of the eye and color analysis. Optical paramet	skin anatomy and ters of biological tis	perfusion. ssue. Dispersion
Computer simulation of of light, Design of optical XP36ASP	invasive measurement techniques in medical diagnostics. Fundamental physiology of the vascular system, hemodynamics, the cardiovascular system. UV, VIS and IR spectroscopy. Fundamental optics of the eye and color analysis. Optical paramet	skin anatomy and ters of biological tis	perfusion. ssue. Dispersion
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Computer simulation of of light, Design of optical XP36ASP Symbolic expressions at evaluation, Lisp implement parallel inference engine XP37ARA Wave theory, geometric acoustics measurement of sound, sound insulations.	invasive measurement techniques in medical diagnostics. Fundamental physiology of the vascular system, hemodynamics, the cardiovascular system. UV, VIS and IR spectroscopy. Fundamental optics of the eye and color analysis. Optical parametral sensors, Optical visualisation principles of translumiscetion and tomography, Optoelectronic systems in medicine. Architecture of Symbolic Computers and abstract programming, self-interpretation, SECD abstract machine, mentations, predicate logic and its inference engine, Prolog inference engine and dynamic algebras, Warren abstract machine, opes. Architectural Acoustics al and statistical acoustics. Acoustical lining and sound absorption. Objective room acoustic parametres. Subjective criteria for the cardiovascular system, hemodynamics, the cardiovascular system is a section of the cardiovascular system, hemodynamics, the cardiovascular system is a section of the cardiovascular system in the cardiovascular system in the cardiovascular system is a section of the cardiovascular system in the cardiovascular system is a section of the cardiovascular system in the cardiovascular system is a	skin anatomy and ers of biological tis ZK mory management timisation, Prolog i ZK for auditory quality al properties of build	perfusion. ssue. Dispersion 4 t, demand-driven implementations, 4 of halls. Room dings: absorption
Computer simulation of of light, Design of optical XP36ASP Symbolic expressions at evaluation, Lisp implement parallel inference engine XP37ARA Wave theory, geometric acoustics measurement of sound, sound insulation in room acoustics.	invasive measurement techniques in medical diagnostics. Fundamental physiology of the vascular system, hemodynamics, the cardiovascular system. UV, VIS and IR spectroscopy. Fundamental optics of the eye and color analysis. Optical parametral sensors, Optical visualisation principles of translumiscetion and tomography, Optoelectronic systems in medicine. Architecture of Symbolic Computers and abstract programming, self-interpretation, SECD abstract machine, mentations, predicate logic and its inference engine, Prolog inference engine and dynamic algebras, Warren abstract machine, opes. Architectural Acoustics al and statistical acoustics. Acoustical lining and sound absorption. Objective room acoustic parametres. Subjective criteria for technique. Physical modelling and numerical simulation of sound propagation. Electroacoustic sound reinforcement. Acoustica on. Simple and complex constructions. Criteria for sound insulation properties of building constructions. Measurement in acoustical simulation of sound propagation.	zK mory management timisation, Prolog i ZK for auditory quality al properties of constructions with a properties of construction in the construct	perfusion. ssue. Dispersion 4 t, demand-driven implementations, 4 of halls. Room dings: absorption ons. Calculations
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XP36RGM	Reading group in data mining and machine learning	ZK	4
	at revealing non-trivial, hidden and ultimately applicable knowledge in large data. Data size and data heterogeneity make two	-	
•	loal is to understand the patterns that drive the processes generating the data. Machine learning (ML) focuses at computer a	•	•
· · · · · · · · · · · · · · · · · · ·	perience and by the use of data. It often puts emphasis on performance that the algorithms reach. The distinction between D		
advanced and modern to	a means of conducting useful data mining. For this reason, we cover both the areas in the same course. The main goal of the poics in the field	ie course is to get	acquainted with
XP13DFD	Data and Functional Analysis of Production Systems	Z,ZK	4
- 1	production enterprise and its structure. Relationship of technological system to other systems. Tools of control and information		· -
	of enterprise. Date base of technical preparation of production. Methodology of functional analysis of enterprise. Methods of		· ·
	ser interface of enterprise IS. Object oriented methodology of analysis of enterprise. Methods of time analysis of enterprise.		
enterprise. Documentati	on and standards for data and functional analysis. Automation of analysis methods, CASE tools.		-
XP34ORD	Optical Radiation Detection and Detectors	ZK	4
Spectrum of electromagi	etic radiation, radiometric and photometric units. Detection of optical radiation. Ideal detectors, internal and external photo-effe	ect. External photo	-effect detectors,
photomultipliers. Interna	photo-effect detectors, PN junction. PIN photodiode, physical principles, properties. Avalanche photodiode, physical princip	oles, properties. Ph	noto-resistors,
	erties. Thermal energy conversion detectors. Bolometers, thermocouples. Pyroelectric detectors. Some other detector types. C	Optical receivers, d	lesign principles,
· ·	cells, properties. Measurement methods, applications.		
· ·	Diagnostics and Reconfiguration of Programmable Circuits	ZK	4
-	help PhD students to understand better methods of reliability and availability improvement of SOC and NOC circuits built on		
l l	Diagnostics of HV and EHV Insulating Systems	Z,ZK	4
·	fault sources and mechanisms. Indoor and outdoor insulation of electrical equipment. Diagnostic methods, using in operation		-
	database systems for electrical machines and equipment of HV and EHV. Application of systems with element of artificial into		
	Electric Discharges and their Applications	ZK	4
	discharges. Townsend?s theory. Glow discharge. Processes on the surface of electrodes. Technological applications. Plasma c. Corona. Spark discharge. Lightning. Ball lightning. Z-pinch and its properties. Electromagnetic collapse. X-ray sources, co	. , .	
magnetic fields of Earth	c. Corona. Spark discharge. Lightning. Ball lightning. 2-pinch and its properties. Electromagnetic collapse. A-ray sources, co	introlled fusion. Ge	eneration of
XP32DZS	Digital Signal Procesing in Telecommunications	ZK	4
		ZK	4
· ·	Distributed Artificial Intelligence	1	•
	/24 the course runs for the last time. In future years, it will not be opened anymore. Distributed problem solving. Multiagent pla Inication strategies, message passing. Various AI approaches, case studies. Types of agent behavior. Negotiation. Organizat		
	stems. Client-server systems. Peer-to-peer systems. Implementation aspects of distributed knowledge-based systems. Learn	-	-
	uitance models, social knowledge, reflectivity in MAS. Coalition formation, team work. Formal models of agent architecture.	iling in mallagent	Systems.
	Distributed Systems	ZK	4
	isms - message exchange, procedural communication (RPC, ORB), distributed shared memory. Process algebras - CSP, CC	1	•
	stributed execution, global state, causality, logical time. Algorithms of: exclusive access, leader election, deadlock detection/p	· ·	
	thms, replication. Mobility, search in distributed systems - DHT.	,	,
XP37DRS	Satellite communication and navigation systems	Z.ZK	4
	Satellite communication and navigation systems - overview. Systems for fixed and mobile service. Satellite networks: Intelsat, Eutelsat, Inmarsat, Intersputnik, Astra. Orbits (Z,ZK (LEO, MEO, GEO,	
Satellite communication		LEO, MÉO, GEO,	HEO) and
Satellite communication parameters of satellite or spectrum communication	- overview. Systems for fixed and mobile service. Satellite networks: Intelsat, Eutelsat, Inmarsat, Intersputnik, Astra. Orbits (ommunication channel. Energetic budget of satellite link. Satellite link design. Frequency bands. Modulations and multiplexes: n. Systems VSAT, DAMA, DVB-S, S-UMTS. Multimedia satellite services. Satellite navigation systems: GPS, GLONASS and Communication systems.	LEO, MEO, GEO, TDMA, FDMA and	HEO) and d CDMA. Spread
Satellite communication parameters of satellite conspectrum communication and navigation systems	- overview. Systems for fixed and mobile service. Satellite networks: Intelsat, Eutelsat, Inmarsat, Intersputnik, Astra. Orbits (communication channel. Energetic budget of satellite link. Satellite link design. Frequency bands. Modulations and multiplexes: n. Systems VSAT, DAMA, DVB-S, S-UMTS. Multimedia satellite services. Satellite navigation systems: GPS, GLONASS and Content of the CNS systems.	LEO, MEO, GEO, TDMA, FDMA and GALILEO. Satellite	HEO) and d CDMA. Spread
Satellite communication parameters of satellite communication spectrum communication and navigation systems XP14DES	- overview. Systems for fixed and mobile service. Satellite networks: Intelsat, Eutelsat, Inmarsat, Intersputnik, Astra. Orbits (communication channel. Energetic budget of satellite link. Satellite link design. Frequency bands. Modulations and multiplexes: n. Systems VSAT, DAMA, DVB-S, S-UMTS. Multimedia satellite services. Satellite navigation systems: GPS, GLONASS and Content of the CNS systems. Dynamics of Electric Machines	LEO, MEO, GEO, TDMA, FDMA and GALILEO. Satellite	HEO) and d CDMA. Spread e communication
Satellite communication parameters of satellite communication and navigation systems XP14DES Electric machines play a	- overview. Systems for fixed and mobile service. Satellite networks: Intelsat, Eutelsat, Inmarsat, Intersputnik, Astra. Orbits (communication channel. Energetic budget of satellite link. Satellite link design. Frequency bands. Modulations and multiplexes: n. Systems VSAT, DAMA, DVB-S, S-UMTS. Multimedia satellite services. Satellite navigation systems: GPS, GLONASS and Content of CNS systems. Dynamics of Electric Machines n important role in a number of areas, such as e-mobility, renewable energy sources utilization, robotics and automation. The	LEO, MEO, GEO, TDMA, FDMA and GALILEO. Satellite ZK ne main objective of	HEO) and d CDMA. Spread e communication 4 of the course is
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Satellite communication parameters of satellite communication and navigation systems XP14DES Electric machines play at to provide the students or FEM will be developed understanding of electric	- overview. Systems for fixed and mobile service. Satellite networks: Intelsat, Eutelsat, Inmarsat, Intersputnik, Astra. Orbits (communication channel. Energetic budget of satellite link. Satellite link design. Frequency bands. Modulations and multiplexes: n. Systems VSAT, DAMA, DVB-S, S-UMTS. Multimedia satellite services. Satellite navigation systems: GPS, GLONASS and Cointegration - CNS systems. Dynamics of Electric Machines In important role in a number of areas, such as e-mobility, renewable energy sources utilization, robotics and automation. The other than the principles, operation, and analysis of rotating electric machinery. Mathematical models based for various types of electric machines (induction machines, electrically excited synchronous machines, permanent magnet stall machine theory on such a level is necessary, for instance, for design of modern control methods of electric drives or constant and the control methods of electric drives or constant in the control methods of electric drives or constant in the control methods of electric drives or constant in the control methods of electric drives or constant in the control methods of electric drives or constant in the control methods of electric drives or constant in the control methods of electric drives or constant in the control methods of electric drives or constant in the control methods of electric drives or constant in the control methods of electric drives or constant in the control methods of electric drives or constant in the control methods of electric drives or control methods of electric	LEO, MEO, GEO, TDMA, FDMA and GALILEO. Satellite ZK The main objective of d on the theory of synchronous mach struction of electric	HEO) and d CDMA. Spread e communication 4 of the course is space phasors nines). Thorough c machines.
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Satellite communication parameters of satellite communication spectrum communication and navigation systems XP14DES Electric machines play at to provide the students or FEM will be developed understanding of electric to the students of	- overview. Systems for fixed and mobile service. Satellite networks: Intelsat, Eutelsat, Inmarsat, Intersputnik, Astra. Orbits (communication channel. Energetic budget of satellite link. Satellite link design. Frequency bands. Modulations and multiplexes: n. Systems VSAT, DAMA, DVB-S, S-UMTS. Multimedia satellite services. Satellite navigation systems: GPS, GLONASS and Cointegration - CNS systems. Dynamics of Electric Machines In important role in a number of areas, such as e-mobility, renewable energy sources utilization, robotics and automation. The with deep understanding of the principles, operation, and analysis of rotating electric machinery. Mathematical models based for various types of electric machines (induction machines, electrically excited synchronous machines, permanent magnet stall machine theory on such a level is necessary, for instance, for design of modern control methods of electric drives or constanting International accounting standards (IFRS). Methodology of accounting. Cost, revenues, profit and cash flow. Balance sheet	LEO, MEO, GEO, TDMA, FDMA and GALILEO. Satellite ZK The main objective of d on the theory of synchronous mach struction of electric	HEO) and d CDMA. Spread e communication 4 of the course is space phasors nines). Thorough c machines. 4
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	Physics for Electroenergetics	ZK	4
	parts of physics for students of electric power engineering: Physical principles of gas discharges - glow, arc, spark and corona quainted with characteristics for magnetized, astrophysical and fusion energy generation. A part of the course is two excursion	_	
Academy of Sciences.	qualified with characteristics for magnetized, astrophysical and tasion energy generation. A part of the course is two execusion	no in laboratorico	OTO and Ozcon
XP34ETS	Electrical Transport in Semiconductors	ZK	4
	ort in semiconductor crystals. Effective mass, mobility Boltzmann's transport equation. Scatter mechanisms, frequency. Scatteri	ng on phonons, io	nised impurities,
I	ation time approximation Carrier transport in a strong electric field, velocity saturation. Carrier transport in magnetic field. Carrier transport in magnetic field.		
	sport, density matrix, Green's and Wigner's functions. Resonance tunnelling, transport of electrons in superlattices. Single e	electron transport,	Coulomb's
	ort. Quantum Hall's effect. Simulation of transport effects. Electrodynamics	ZK	4
	Electrodynamics Electromagnetic Compatibility	ZK	4
	Electromagnetic Compatibility erference coupling. Shielding. Earthing. Nonlinear consumers. Harmonics in electric convertors in steady and transient condi		•
	e network. Compensation and filtration.		
XP38EMC	Electromagnetic Compatibility of Data Acquisition Systems	ZK	4
EMC - basic terms. Mea	surement of electromagnetic emission and immission. EMC standards. Modelling of disturbing signals. Electromagnetic distu	rbance in laborate	ory and industry.
	with regard to EMC. EMC of data transmitting lines.		
	Energy Economy	Z,ZK	4
"	national economy. Terminology of energy economy. The energy systems. Forecast of energy consumption. Energy balance in lomy and its impact to environment. Energy economy on the organization level. The control of energy economy. Basic problem	•	• • • • • • • • • • • • • • • • • • • •
	Control in Power Engineering	Z,ZK	4
-	I problems. The role of power engineering. Global climate change. The greenhouse effect. Carbon dioxide emissions.Impact	,	-
	enewable energy sources. Methods and technology for decreasing of impact to environment. Electric power transmission and	•	
power energy system			
	Evolutionary Computing	ZK	4
	ary computing in contrast to classical computing techniques, Genetic algorithms (GA) for optimisation. The Simple Genetic A		
1	ve phenomena. GA and constrained tasks, special representations. Genetic Programming (GP), relationship to GA. GP typica Special methods for improving GA performance.	I tasks, GP and m	achine learning.
	Expert Systems in Electrical Power Engineering	Z,ZK	4
	luation. Expert systems in electrical power engineering and diagnostics of insulating systems. Application of rule-based exp		
	pering and diagnostics of insulating systems. Creation of expert systems for electrical power engineering and electro diagno	=	
XP16FVT	Philosophical Problems of Science and Technology	ZK	2
	n the evolution of principal ideas on which the science and technology are founded. Philosophical aspects of physics and ma	thematics are de	eper examined.
	he so called "Postmodernism" and to the alternative ways of understanding and their social coherences are discussed.	-	
	Financial Management	ZK	4
1	sent value and alternative cost of capital, net present value, present value of bonds and stocks, investment decision making , risk and return, lease or buy decision, inflation and return, real options, financial options, option valuation, hedging, short t	· ·	
	Phonetic signals and their coding	ZK	4
	he processing of speech signals. Within the subject students should manage from basic to advanced and modern algorithms	1	
coding or enhancement.	Further reasonable part is focused on speech recognition, where students will get to know modern and advanced technique in t	ask as small and l	arge vocabulary
	eaker recognition. Special attention is devoted to usage of classification techniques based on GMM, DTW, HMM, ANN/DNN		
	Photometry and Colorimetry	Z,ZK	4
	methods. Standards of luminance and luminous flux. Receivers of radiation and modification of their characteristics. Photom Luminaire parameters. Measuring of indoor lighting systems. Measuring of outdoor luminance and illuminance. Colour visior		
	ir rendering-index. Chromaticity system. Diagram of chromatic. Colorimeter. Spectroscop	r trieory. Criromat	icity. Colour.
	Photonic Imaging Systems	ZK	4
	tion. Energetic image description. Principles of image acquisition, transferring and storing. Image entropy function, 2 dimens		
probability image descrip	tion. Novel compression techniques. Image reproduction, matrix description. Light diffraction. 2D transfer functions - PSF, M	TF, PSF, MTF of r	eal imaging and
detection systems. 2D tra	ansfer systems and their signal distortion, image aberration and their correction, toleration analysis of optical system. Receiv		
		ers and transmitte	ers for special
<u> </u>	cessors, computers and memories.		•
XP13FCD	Photovoltaics systems	Z,ZK	4
XP13FCD The course discusses th	Photovoltaics systems e most important problems of principle, technology of production and final use of photovoltaic systems for power generation.	Z,ZK Topics: Solar ene	4 ergy and basic
XP13FCD The course discusses th principles of conversion.	Photovoltaics systems	Z,ZK Topics: Solar ene	4 ergy and basic teristics of
XP13FCD The course discusses th principles of conversion. photovoltaic cells. Determ	Photovoltaics systems e most important problems of principle, technology of production and final use of photovoltaic systems for power generation. Photovoltaic effect, photovoltaic cells. Optimization of cell structure in terms of optical and electrical properties of individual I	Z,ZK Topics: Solar eneayers. V-A characteristics of the control of	4 ergy and basic teristics of es of production
XP13FCD The course discusses th principles of conversion. photovoltaic cells. Determ of basic types of photovo	Photovoltaics systems e most important problems of principle, technology of production and final use of photovoltaic systems for power generation. Photovoltaic effect, photovoltaic cells. Optimization of cell structure in terms of optical and electrical properties of individual Inination of the maximum theoretically achievable energy conversion efficiency of a given structure. Photovoltaic modules. Tech	Z,ZK Topics: Solar energy ayers. V-A character nological process systems (autonomical control of the control of	4 ergy and basic teristics of es of production nous, connected
XP13FCD The course discusses th principles of conversion. photovoltaic cells. Deterr of basic types of photovo to the grid). Components	Photovoltaics systems e most important problems of principle, technology of production and final use of photovoltaic systems for power generation. Photovoltaic effect, photovoltaic cells. Optimization of cell structure in terms of optical and electrical properties of individual I nination of the maximum theoretically achievable energy conversion efficiency of a given structure. Photovoltaic modules. Tech taic cells and modules. Characterization and diagnostic methods, analysis of failure types, influence on durability. Photovoltaic	Z,ZK Topics: Solar energy ayers. V-A character nological process systems (autonomical control of the control of	4 ergy and basic teristics of es of production nous, connected
XP13FCD The course discusses the principles of conversion. photovoltaic cells. Determ of basic types of photovo to the grid). Components XP04F1ZK XP04F1	Photovoltaics systems e most important problems of principle, technology of production and final use of photovoltaic systems for power generation. Photovoltaic effect, photovoltaic cells. Optimization of cell structure in terms of optical and electrical properties of individual I nination of the maximum theoretically achievable energy conversion efficiency of a given structure. Photovoltaic modules. Tech taic cells and modules. Characterization and diagnostic methods, analysis of failure types, influence on durability. Photovoltaic of photovoltaic systems. Simulation of yield for a given type of climate and season. Trends in applications of photovoltaic sys French language 1 French language 1	Z,ZK Topics: Solar eneayers. V-A characteristics of the solar eneayers and process systems (autonomatems and economics and economics of the solar eneayers of the solar eneagers	4 ergy and basic teristics of es of production nous, connected mic aspects.
XP13FCD The course discusses the principles of conversion. photovoltaic cells. Determ of basic types of photovo to the grid). Components XP04F1ZK XP04F1 Basic knowledge of grant	Photovoltaics systems e most important problems of principle, technology of production and final use of photovoltaic systems for power generation. Photovoltaic effect, photovoltaic cells. Optimization of cell structure in terms of optical and electrical properties of individual I nination of the maximum theoretically achievable energy conversion efficiency of a given structure. Photovoltaic modules. Tech taic cells and modules. Characterization and diagnostic methods, analysis of failure types, influence on durability. Photovoltaic of photovoltaic systems. Simulation of yield for a given type of climate and season. Trends in applications of photovoltaic sys French language 1 French language 1 mar and vocabulary, with the emphasis on technical style; ability to understand technical texts on an intermediate level (tes	Z,ZK Topics: Solar eneayers. V-A characteristics of the solar eneayers and process systems (autonomatems and economics and economics of the solar eneayers of the solar eneagers	4 ergy and basic teristics of es of production nous, connected mic aspects.
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XP13FCD The course discusses the principles of conversion. photovoltaic cells. Deterror of basic types of photovoto the grid). Components XP04F1ZK XP04F1 Basic knowledge of grant texts). Oral presentations XP04F2ZK XP04F2 Very good proficiency bot texts (cca 120 pages). Oskills related to job appliit XP01FA1 Measure theory and Leb	Photovoltaics systems a most important problems of principle, technology of production and final use of photovoltaic systems for power generation. Photovoltaic effect, photovoltaic cells. Optimization of cell structure in terms of optical and electrical properties of individual Initiation of the maximum theoretically achievable energy conversion efficiency of a given structure. Photovoltaic modules. Tech taic cells and modules. Characterization and diagnostic methods, analysis of failure types, influence on durability. Photovoltaic of photovoltaic systems. Simulation of yield for a given type of climate and season. Trends in applications of photovoltaic systemch language 1 French language 1 Image:	Z,ZK Topics: Solar ene ayers. V-A character nological process systems (autonon stems and econoristems are also a constant and econoristems are also according to the econo	4 ergy and basic teristics of es of production nous, connected mic aspects. 0 ca 60 pages of 0 prehension of stering language
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XP35FMD	Fuzzy Modelling and Control	ZK	4
The goal of the subject i	is to introduce the up-to-date trends and results in the area of modelling and control of nonlinear systems based on fuzzy logic	and neural networ	ks. This includes
	synthesis of Takagi-Sugeno fuzzy systems, utilization of fuzzy systems and neural networks in control of nonlinear systems I	by approximation	of unknown
	the description of the system, and design of adaptive fuzzy systems both direct and indirect.		
XP37FZS	Fuzzy Signal Processing	Z,ZK	4
	n and their research activities are focused on the problems of utilize fuzzy logic and neural network for optimization algorithm us	sed at numerical s	ignal processing
	agnostic of the signal, control phase lock and so on.		
XP13FDD	Physic of Dielectrics	Z,ZK	4
	us of polarization. Dielectric absorption. Electrical conductivity of insulators. Dielectrics in static electrical field. Dielectrics in til		
	of polymers. Thermal dispersion of polymers. Optical properties of dielectrics. Dielectrics losses. Electrical strength of insulators of insulators. Properties of feroelectrics. Main and joined phenomena in dielectrics.	rs. Electrical prop	erties of thin
XP02FPL		71/	4
-	Solid State Physics	ZK	4
	ndamentals of solid state physics at large.	7.71/	4
XP13FPD	Semiconductor Physics	Z,ZK	4
components technology	s to deepen the knowledge of the properties of semiconductor materials and structures that are important for a deeper under ,	standing of the se	emiconductor
XP37FHA		ZK	4
-	Physiological, Psychological and Musical Acoustics organ, hearing theory, hearing field, loudness, masking, pitch of sound, temporal tresholds, distortion in the hearing organ, a	1 .	•
	tural hearing, objective and subjective properties of musical signals, statistical and dynamical analysis. Perception of simple t		•
	nancy. Psychoacoustics of transmission of the musical signal. Methods of psychoacoustic measurements, their validity, repeat		
	ods of statistical analysis of results, interpretation.		
XP37FHA1	Physiological, Pychologycal and Musical Acoustics 1	ZK	4
-	ignal in temporal and frequency domains, methods of sound synthesis, timbre and interpretation of sound spectra, objective	1	· -
•	ion to acoustics of speech and singing, physical -acoustic principles of musical instruments, tuning, dynamics, timbre of the to		-
instruments, introductio	n to methodology of measurement of musical instruments.		
XP37GAB	Genesis and Analysis of Biosignals	ZK	4
	penesis and description of the most important biological signals of both electric and non-electric nature. Properties of the biosign	nal, essential for th	ne consequential
signal processing, are s	studied. Finally, simple and advanced methods of biosignals pre-processing, analysis and evaluation are presented for each t	he biosignal.	
XP33GAD	Geometrical Algebras	ZK	4
Algebraic structures use	ed in geometry: Groups and linear spaces, ordered groups and fields, othogonal groups, Clifford algebras, etc. Discussion of	potentital applica	tions in image
processing.			
XP02HS	Noise Surveys	ZK	4
Sound field, noise and	vibration measurement, noise legislation, hygiene control. Types of noise surveys, examples, types of noise sources. Noise m	napping, principles	and types of
sources. Noise in worki	ng environment. Noise in buildings. Transport noise, airport noise. Technical principles of noise control.		
XP36HS	Hypermedia Systems and Internet Computing	ZK	4
	pasic models. Intelligent searching, adaptive navigation, personalization of access to web applications. Web intelligence, semi	antic web. Web er	ngineering, main
	t. Internet computing. Modern technologies for web applications design.		
XP33IMD	Informatics in Clinical Medicine	ZK	4
· · · · · · · · · · · · · · · · · · ·	d by automatized systems. Specific problems of medical informatics. Computer supported documentation in doctor's work. Ho	-	-
•	nation system projects from the point of view of medicine. Introduced hospital information systems. Diagnosis theory, computer a	_	_
•	cation in medicine. Database systems, biomedical databases. Computers in clinical biochemical laboratories. Computers in n	netabolic and inte	nsive care.
	y planning. Standardiyation and communication between information systems in medicine. Specialized computer networks.	71/	4
XP01ITZ	Integral Transforms and Z Transform	ZK	4
	ransforms, linearity. Laplace transform, inversion, limit theorems. Fourier transform. Application to solving integral and differei ier and Laplace transforms of distributions. Linear dynamic systems, causality, passivity, convolution. Systems with bounded sp	-	
equations.	ner and captace transforms of distributions. Einear dynamic systems, causality, passivity, convolution, systems with bounded spi	ectium. Z-transion	in and dilierence
XP34IO	Integrated Option	ZK	4
	Integrated Optics Integrated Optics Integrated Structure design. Waveguide coupling elements. Gratings structures at waveguide structure design. Waveguide coupling elements.		
	Design and preparation of dielectric and polymer waveguides and structures. Optical waveguide gratings. Passive waveguide	-	-
	mo-optical effects and their use for IO. Structures for control of optical radiation Devices based on nonlinear effects. Semico		
•	al components for informatics and sensors, multiplexing and optical processing. Applicable measurement methods, principles	•	
optics application.			_
XP12IMM	Engineering Methods in Mechanics	Z,ZK	4
Review methods solutio	on of problems in rigid bodies mechanics, hydromechanical, thermodynamic and electromechanical systems. Dynamics of com		h using methods
of vectorial and analytic	cal mechanics, assembling of mathematical model and resources for simulation. Identification of system parameters with resp	ect to passive res	sistances and
energy losses. Physical	similarity and analogy, dimensional analysis, dimensionless parameters, PI-terms, fundamentals of experimental research		
XP36JAI	Languages for Artificial Intelligence	ZK	4
The course offers a dee	ep insight into the two programming languages that are most frequently used in the domain of artificial intelligence (Lisp, Prol	og). It exhibits pro	gramming
paradigms used to build	d typical AI algorithms and gives some basics concerning the implementation of the two languages.		
XP01KAS	Complexity and Combinatorical Algorithms	ZK	4
Time and space comple	exity of algorithms. P and NP problems and their solutions: exact solutions, heuristics, approximation schemes, probabilistic alg	jorithm. Equivalen	ces of problems.
XP36KP	Communication Protocols	ZK	4
Communication protoco	ol principles, SDL language, protocol architecture: ISO OSI, error control, data-link layer protocols: X.25, higher layer protocols	s (TCP, TP4), com	municating finite
· · · · · · · · · · · · · · · · · · ·	nentation tools (FSM language ESTELLE, regular grammars), use of Petri nets, specification language LOTOS, protocol trans	sformation, design	, synthesis,
validation and verification			
XP34CNO	Integrated Optics	ZK	4
	ogical principles of IO Basic materials for IO. Light propagation in waveguide structures. Methods of waveguide structure desig	_	
	actures. Modal spectroscopy. Fundamental physical effects and interactions for IO. Preparation of dielectric waveguides and s		waveguide
	cal modulators. Applicable measurement methods. Devices based on nonlinear effects. Semiconductor integrated opto-electrons		4
XP16KVM	Quantitative Research Methods in Management	ZK	4
research and managem	SPSS for advanced statistical methods as multiple regression and correlation, analysis of variance, factor analysis, cluster an	iaiyəiə dilu ils USI	ng in marketing
. 555Gron and managem			

XP01KVP	Quantum Computing	ZK	4
	presents a new programming paradigm. The safety of nowadays encypering techniques is based on enormous computation co Tay be broken by quantum computers. The ``building stones" of a quantum computer and quantum computers will be develop		
•	nalgorithms, fast database search, etc.	ed during the cod	ise. we will
XP17LAE	Medical Applications of Electromagnetic Field	ZK	4
	M Field medical applications. Principals and technical equipment for EM thermotherapy, hyperthermia applicators. Calculation		
	nicrowave thermotherapy apparatus are given, especially from the point of view of applicators for local, intracavitary and regic rasound and radiometry) and special compatible applicators are described.	nal treatment. No	n-invasive
XP37LN	Aircraft Navigation	ZK	4
XP35LMI	Linear Matrix Inequalities	ZK	4
	ing or optimization over linear matrix inequalities (LMIs) is an extension of linear programming to the cone of positive semide	1	
an important modern to	ol in systems control and signal processing. Theory: Convex sets represented via LMIs; LMI relaxations for solution of non-control and signal processing.	onvex polynomial	optimization
	algorithms to solve LMI problems; Solvers and software; LMIs for polynomial mehods in control. Control applications: robustne	ss analysis of line	ar and nonlinear
	d-order robust controllers with H-infinity specifications. For more information, see http://www.laas.fr/~henrion/courses/lmi	ZK	4
XP35LSD This course builds upon	Linear Systems the master program lectures on Dynamical Systems Theory. The structure and properties of linear multi-input multi-output sys	1	
•	design of linear controls is demonstrated. The presentation focuses on pole placement techniques, linear state regulation and		-
design. State-space and	d transfer-function design techniques are compared. The lectures are supported by laboratory experiments using Matlab, Contro	ol System Toolbox	, and Polynomial
Toolbox.			
XP36LSM	Logical Simulation	ZK	4
	simulation: fundamental ideas and principles of simulation systems, synchronous and asynchronous simulation. Simulation syst ppes, entities, architectures, sequential environment (processes, functions, procedures), signals and their attributes, resolutio		
-	plocks, structural description), configuration of structural models. Students who completed course 36SIM cannot enroll.	ii ianonon, parane	on on whom home
XP33LPD	Logic and Logic Programming	ZK	4
_	d its relation to technical disciplines. Formal system and its essential properties - validity, completeness. Syntax and semantic		
	guage and its interpretation. Theory and its model, Herbrand's model. Herbrand's theorem, Gödel's completeness theorem and are the little beginning and Barbard an	•	•
•	and probability. Logic programming and Prolog language. Metodology of logic programming. Introduction of extralogical feature Imming (CLP)and inductive logic programming (ILP). Some practical examples of complex logic programs and practical applic		ates. New trends
XP38MPX	Magnetism in Engineering Practice	ZK	4
	ced into the magnetic materials, magnetic sensors and engineering magnetism including FEM design and magnetic measure	1	
this advanced course c	an be modified according to the students' needs.		
XP02MHD	Magnetohydrodynamics	ZK	4
	of the behaviour of hot plasma in magnetic fields		
XP16MAN	Management	ZK	4
XP16MAV	ent and its innovation, modern ways of management, responsibility of managers, manager's ethics, successful manager think Production Management	ZK	4
-	process in promoting the marketing concept of the firm and the competitive advantage. The system of operational planning wi		
	production management, standardization. Controlling, production management methods.		,, 6,
XP16MAU	Accounting for management	ZK	4
	gerial accounting. Relations to the organisational structure of the enterprise and to the production process. Budgets, use for m	anagement. Calcı	ulations and cost
	and measurement of productivity in the production process. The managerial information systems.	71/	4
XP16MAR The role and functions of	Marketing If the marketing management, Marketing research and marketing information system, Concepts of marketing strategy. The use	∠K e of product life cv	d
	licy, pricing and contractation policy, communication, distribution. Marketing mix.	, or product inc cy	cic and portiono.
XP16MAS	Marketing Strategies	ZK	4
Broadening of basic known	owledge of marketing. The analysis of marketing strategies in different market situations. The firm's behavior under competition	on and competitiv	e advantage.
	d of product policy, price and condition policy, communication policy and distribution policy.		
XP01MST	Mathematical Statistics	ZK	4
1 0,	ered sampling and their distributions. Sample statistics. Point estimates and interval estimates.Confidence intervals. Estimatic esting for distribution parameters. Hypothesis testing for equality of parameters. Nonparametric tests. Regression analysis.	ins, unbiased and	consistent
XP01MTS	Mathematical Methods in Signal Theory	ZK	4
	eriodic and almost periodic signals. Fourier series and Fourier integral. Band-limited signals. Theorems of Paley-Wiener and	1	
Analytic signals.			
XP01MKR	Mathematics for cryptography	ZK	4
	ry of groups, finite fields, and polynomials over finite fields and their applications in cryptography.		
XP33MKD	Mathematics for Cybernetics - Selected Topics	ZK	4
	athematics. Ordering, lattices, Boolean algebras, representations. Topological spaces. Metric spaces, completeness, fixed-poi constructions with linear spaces. Systems of linear equations, spectral theory. Matrix calculus, matrix inequalities. Least squares		• •
· · · · · · · · · · · · · · · · · · ·	ntary theory of Hilbert spaces. Introduction to category theory.	and omgalar value	o docomposition.
XP01MTP	Matrix Calculus	ZK	4
	blocks, Jordan canonical matrices. Real canonical form of a real matrix. Characteristic and minimal polynomial. Caley-Hamilton		
-	etric, orthogonal and positive matrices. Diagonalization of symetric, positive and circulant matrices. Singular value decompositi	on. Moore-Penros	e pseudoinverse
	ution of systems of linear equations.	7 71/	4
XP15MPE Basic model modules, m	Mechatronics in Electrical Power Engineering nodels and control systems of steam generators,steam and water turbines and nuclear reactor. Dynamics and control of STATCON	Z,ZK	compensatores.
XP38MMN	Measurement of Nonelectric Quantities	ZK	4
	ensors. Measurement of temperature, pressure, flow, movement, position and other physical quantities. Chemical sensors an	1	
	explosives. New types of signal conditioning circuits. Sensor Applications in industry, transport and consumer electronics. Sec	curity and military	applications.
	analogy Cignal processing in concer systems, intelligent concers		

XP15MVN	High Voltage Measurement	Z,ZK	4
Types of testing voltage	s and high voltage generators. Measurement cables, attenuators. Disturbances of HV measurement. Measurement of impuls	e voltages by volt	age dividers,
	rs for measurement of fast transients, calibration of dividers. Measurement of DC high voltages, HV resistors and dividers. Measurement of DC high voltages, HV resistors and dividers.		
	ment of RMS voltages. Instruments for measurement of voltage peak values. Measurement of high current, shunt reactors, F	Rogowski coil. Me	asurement of
	tilization of optical-fibre waveguides. Voltage tests of transformers. HV measurement of dielectrics.		
XP17MVP	Methodology of Science	ZK	
XP37MVP	Scientific Work Methodology	ZK	4
	of scientific work, exploitation of literature and other information resources, accessible databases, fundamentals of project		-
projects, formal requirer	nents (PhD Thesis, article, conference), patents and patent search, Internet exploitation, discussion groups, WWW presenta		sentation.
XP17MAPP	Analysis Methods for Passive Elements of Microwave and Millimeter-wave Technique	ZK	4
•	sion lines parameters. Computation of microwave circuits scattering parameters, analysis of planar antennas. Survey of basis		
	n methods: spectral domain, integration equation, finite differences, finite elements, mode matching, transversal resonance.	Survey of basic th	neorems of
	noment method, disturbance method.		
XP38MDR	Methods of Signals Digitalization and Reconstruction	ZK	4
· · · · · · · · · · · · · · · · · · ·	onventional methods of analog preprocessing of typical sensors signals, selection of optimal digitization methods and optimization	tion of hardware s	olution including
	ement results to achieve high accuracy and effective suppression of disturbing signals.		
XP38MPM	Methods for Precision Measurement of Electrical Quantities and Measurement Data Processing		4
	ectrical quantities. Collective standards. Inductive ratio devices for precision electrical measurements and possibilities of improv		•
•	cision measurement of active and passive electrical quantities. Evaluation of measurement errors and uncertainties. Metrolo	igical reliability. St	atistical analysis
of measurement data.			
XP14MIR	Microprocessor Control of Electric Drives	ZK	3
	I signal processor (DSP), digital signal microcontroller (DSC), architecture, computational resources, fixed point, fraction, float	• .	
	special blocks, ADC, event memory, FIFO, CAM, Multiport RAM, impulse signal generation, serial communication, methods, I		
	parallel processing, RT systems, solution methods, systems: INT, BG-FG, FSA, CC, preemptive RTOS, tasks, queues, sem-	apnors, criticai se	ection, control
	methods, control computer resources application in scalar and vector control of electric drives.	717	4
XP34MSY	Microsystems	ZK	4
	and classification of microsystems. Micro-sensors. Micro-actuators. Signal processing within the system. MEMS (micro-electric		*
	structures). MEMOS (micro-electrical-mechanical-optical structures). Microsystem design. Microsystem modelling. Manufacti	uring technologies	s. Materials.
Industrial applications.		71/	4
	Microwave Technique	ZK	4
	lines and its circuit elements including hybrid and monolithic integrated circuits technology. Resonators and other type of paralleless and circulators, modulators, m		
CAD of microwave circu	olators and circulators, modulators etc.) and active microwave circuits (e.g. oscillators, mixers and amplifiers), microwave filte	ers, microwave me	easurement.
		71/	4
XP32MOS	Mobile Networks	ZK	4
	students with evolution and standardization of mobile networks and mainly provides a detailed description of network architectu . The course as well depicts trends and the future development of mobile networks.	ires and discusses	basic principles
used in mobile networks	i. The course as well depicts trends and the ruture development of mobile networks.		
VD22MOL	Model Legise for Distributed Customs	71/	1
XP33MOL	Modal Logics for Distributed Systems	ZK	4 Proportion of
A model of knowledge in	n distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possib	le-worlds model. I	
A model of knowledge in knowledge. Correspond	n distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possib ence between axioms and properties of possibility relation in the model. Knowledge in MAS. Common knowledge and agree	le-worlds model. I ment.	Properties of
A model of knowledge in knowledge. Correspond XP13MSD	n distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possiblence between axioms and properties of possibility relation in the model. Knowledge in MAS. Common knowledge and agreed Modelling and Simulation of Technological Systems	le-worlds model. I ment. Z,ZK	Properties of
A model of knowledge in knowledge. Correspond XP13MSD Program tools of comput	n distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possiblence between axioms and properties of possibility relation in the model. Knowledge in MAS. Common knowledge and agreed Modelling and Simulation of Technological Systems ter modelling and simulation. Programs processing port diagrams or block diagrams. Text edited systems and examples. Grap	le-worlds model. I ment. Z,ZK phic edited system	Properties of 4 as and examples
A model of knowledge in knowledge. Correspond XP13MSD Program tools of computer - SIMULINK. Modelling	n distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possible ence between axioms and properties of possibility relation in the model. Knowledge in MAS. Common knowledge and agreed Modelling and Simulation of Technological Systems let modelling and simulation. Programs processing port diagrams or block diagrams. Text edited systems and examples. Grap of electric and electronic systems. Models of power semiconductor devices, modelling of power semiconductor systems. Examples.	le-worlds model. I ment. Z,ZK phic edited system	Properties of 4 as and examples
A model of knowledge in knowledge. Correspond XP13MSD Program tools of computer - SIMULINK. Modelling mechanical and electron	n distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possible ence between axioms and properties of possibility relation in the model. Knowledge in MAS. Common knowledge and agree Modelling and Simulation of Technological Systems ter modelling and simulation. Programs processing port diagrams or block diagrams. Text edited systems and examples. Grap of electric and electronic systems. Models of power semiconductor devices, modelling of power semiconductor systems. Examples of simulations.	le-worlds model. I ment. Z,ZK ohic edited system mples of simulatio	Properties of 4 as and examples ons. Modelling of
A model of knowledge in knowledge. Correspond XP13MSD Program tools of computer - SIMULINK. Modelling mechanical and electron XP33ICT	n distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possible ence between axioms and properties of possibility relation in the model. Knowledge in MAS. Common knowledge and agree in Modelling and Simulation of Technological Systems ter modelling and simulation. Programs processing port diagrams or block diagrams. Text edited systems and examples. Grap of electric and electronic systems. Models of power semiconductor devices, modelling of power semiconductor systems. Examples of simulations. Modern ICT for Industry and Smart Grids	le-worlds model. I ment. Z,ZK phic edited system mples of simulatio	Properties of 4 as and examples ons. Modelling of
A model of knowledge in knowledge. Correspond XP13MSD Program tools of compusion - SIMULINK. Modelling mechanical and electron XP33ICT XP14MRP	n distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possible ence between axioms and properties of possibility relation in the model. Knowledge in MAS. Common knowledge and agreed Modelling and Simulation of Technological Systems let modelling and simulation. Programs processing port diagrams or block diagrams. Text edited systems and examples. Graph of electric and electronic systems. Models of power semiconductor devices, modelling of power semiconductor systems. Examples of simulations. Modern ICT for Industry and Smart Grids Advanced Controlled Drives	le-worlds model. I ment. Z,ZK hic edited system mples of simulation ZK ZK	4 as and examples ons. Modelling of 4
A model of knowledge in knowledge. Correspond XP13MSD Program tools of computer - SIMULINK. Modelling mechanical and electron XP33ICT XP14MRP XP37MSC	a distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possible once between axioms and properties of possibility relation in the model. Knowledge in MAS. Common knowledge and agreed Modelling and Simulation of Technological Systems ter modelling and simulation. Programs processing port diagrams or block diagrams. Text edited systems and examples. Graph of electric and electronic systems. Models of power semiconductor devices, modelling of power semiconductor systems. Examples of simulations. Modern ICT for Industry and Smart Grids Advanced Controlled Drives CNS Modern Systems	le-worlds model. I ment. Z,ZK hic edited system mples of simulation ZK ZK ZK ZK ZK	Properties of 4 as and examples ons. Modelling of 4 3 4
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A model of knowledge in knowledge. Correspond XP13MSD Program tools of computing significant in the course is electromechanical energia mainly focused on electromechanical energia mainly focused one	a distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possible ance between axioms and properties of possibility relation in the model. Knowledge in MAS. Common knowledge and agree Modelling and Simulation of Technological Systems Modelling and Simulation of Technological Systems Item modelling and simulation. Programs processing port diagrams or block diagrams. Text edited systems and examples. Grap of electric and electronic systems. Models of power semiconductor devices, modelling of power semiconductor systems. Examechanical systems, hydraulic systems and thermal systems. Examples of simulations. Modern ICT for Industry and Smart Grids Advanced Controlled Drives CNS Modern Systems Advanced Power Semiconductor Devices and ICs all structures. Development trends. Parameters and applications. Bipolar structures. MOS structures. BiMOS structures. Plat transistors. Thyristors (including GTO and MCT). Secondary breakdown, mechanism, safe area. Smart-power devices. High New Control Methods for Electric Drives to introduce students to the latest issues of control and regulation of electric drives, taking into account the focus of their doctor by conversion parameters in electric drive systems and relevant power electronics, in particular by using modern control and circi AC drives, especially drives with asynchronous and synchronous motors. Multimedia Signals Transmission tion system scheme. Extended knowledges in radio transmitters and radio receivers. Radio transmitters and receivers system acidolephone systems. Terrestrial and satellite digital broadcasting. Analog and digital radiorelay systems. Metallic communication systems. Modulation and multiplexing in optoelectronic systems. Cable television networks, interactive telephonent trends. Electromagnetic compatibility. Design and circuit structures of electronic systems portant applications of analogue technique. The subject is divided into the three basic parts. The first part is devoted t	le-worlds model. Iment. Z,ZK Dhic edited system mples of simulation and simulation are provided by the control of the contro	Properties of 4 as and examples ons. Modelling of 4 3 4 diodes. Bipolar ation, principles, 4 ase is to optimize hms. The course 4 communication Noncoherent Mobile 4 functional blocks mode are also nd their field of including f the analyzed optimization. 4 agnitude, phase
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A model of knowledge in knowledge. Correspond XP13MSD Program tools of computing support of the	a distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possibility relation in the model. Knowledge in MAS. Common knowledge and agreei Modelling and Simulation of Technological Systems. The modelling and simulation of Technological Systems are modelling and simulation. Programs processing port diagrams or block diagrams. Text edited systems and examples. Grap of electric and electronic systems. Models of power semiconductor devices, modelling of power semiconductor systems. Examelechanical systems, hydraulic systems and thermal systems. Examples of simulations. Modern ICT for Industry and Smart Grids Advanced Controlled Drives CNS Modern Systems Advanced Power Semiconductor Devices and ICS 2nd structures. Development trends. Parameters and applications. Bipolar structures. MOS structures. BiMOS structures. PN of transistors. Thyristors (including GTO and MCT). Secondary breakdown, mechanism, safe area. Smart-power devices. High New Control Methods for Electric Drives to introduce students to the latest issues of control and regulation of electric drives, taking into account the focus of their doctor by conversion parameters in electric drive systems and relevant power electronics, in particular by using modern control and actric AC drives, especially drives with asynchronous and synchronous motors. Multimedia Signals Transmission tion system scheme. Extended knowledges in radio transmitters and radio receivers. Radio transmitters and receivers system radiotelephone systems. Terrestrial and satellite digital broadcasting. Analog and digital radiorelay systems. Metallic communication systems. Modulation and multiplexing in optoelectronic systems. Cable television networks, interactive telepoment trends. Electromagnetic compatibility. Design and circuit structures of electronic systems higher processing. Special application amplifiers, nonlinear and parametric analog functional blocks and fast analog circuits op part is devoted to linear analo	le-worlds model. I ment. Z,ZK Dhic edited system mples of simulation and the system mples of simulation and the system mples of simulation and the system	Properties of 4 as and examples ons. Modelling of 4 3 4 diodes. Bipolar ation, principles, 4 ase is to optimize hms. The course 4 communication Noncoherent Mobile 4 functional blocks mode are also nd their field of , including f the analyzed optimization. 4 agnitude, phase ign of FIR filters,

XP34PIC	Programmable IC Design	ZK	4
	s to acquaint students with advanced methods of design, synthesis and verification of programmable systems and systems w pasic building elements, architecture and design procedures used to implement complex integrated systems, methods of desc		-
	n verification strategy, design and analysis of tests. This project-oriented course would with the use of state-of-the-art EDA to	•	•
	d system whose application would be linked to the topic of the dissertation.	•	•
XP37NRO	CAD for RF and Microwave Circuits	Z,ZK	4
	conductor devices and transmission lines implemented in the PSpice class and similar programs. Hierarchy of the models of oth nodel accuracy with artificial neural networks (ANN). Advanced algorithms for analysis and optimization of RF and microwave ci		
XP35NES	Nonlinear Systems	ZK	4
	a continuation of the master level course "Nonlinear systems" being opened during winter semester. It is devoted to the deta		•
structure from the contr	ol design point of view. It is based on state space descripion of nonlinear systems. Model transformations will be studied to si	implify them and t	hereby faciliate
_	gives mathematical conditions for the existence of these transformations. Nonlinear analougues of controllability and observal	-	
	n to detectability and stabilizability investigated. Finally, elements of nonlinear output regulation as well as of nonlinear robust Il be, in particular, based on MATLAB and SIMULINK use.	and adaptive des	sign will be
XP04N1	German language 1	NIC	
Extending skills with the	emphasis on professional language. Listening to authentic technical texts from areas of electrical engineering, eliciting basic	information from t	he text. Reading
	onal texts regarding the needs of postgraduate students. Training of various reading skills. Writing technical texts on specific		
	r advanced students based on 5 video tapes about these topics: postgraduate studies, professions, internships abroad, profe	essional and scier	tific work, the
XP04N1ZK	er. Revising and extending typical grammar for technical style, syntax of technical texts.	ZK	0
	German language 1 emphasis on professional language. Listening to authentic technical texts from areas of electrical engineering, eliciting basic		_
_	onal texts regarding the needs of postgraduate students. Training of various reading skills. Writing technical texts on specific		=
conversation lessons fo	r advanced students based on 5 video tapes about these topics: postgraduate studies, professions, internships abroad, profe	essional and scier	tific work, the
-	er. Revising and extending typical grammar for technical style, syntax of technical texts.		
XP04N2	German language 2	NIC	
presentations etc.)ation	on extending and elaborating grammar and conversation, namely on professional language skills (reading + writing technical	texts, preparing p	papers, reviews,
XP04N2ZK	German language 2	ZK	0
XP36NSN	Neural Networks and Neurocomputers	ZK	4
	, paradigm classification and artificial neural networks learning methods. Student is supposed to propose and test the applica		•
for a partial issue conce	rning his dissertation theme during the semester. Procedure and results would be concluded in the preliminary publication fo	rm designed to be	e presentable on
a scientific forum.			
XEP33NEP	Neuroprosthetics	Z,ZK	4
· ·	cerned with the use of artificial devices to replace or improve the function of the human nervous system. The neuroprosthetic rith approximately 150,000 in use worldwide. In this course we will look at the different technologies involved, particularly in te		-
· ·	tical use. We will also see how such implants interact with the human nervous system, forming a bidirectional gateway both t	•	
•	timulate the human brain. As well as witnessing the exciting development of the field we will consider neuroprosthetics in term	•	
	s but also for visual and motor repair. We will however also look at the possibilities of Neuroprosthetics for general human en		-
	experimentation fits into teh field. Whilst the course will focus on technical issues, it will be presented in a general way such		
	cal background is not a requirement). Indeed as this technology has immediate impact, societal, ethical and moral issues rais by to the lecture course given on Bionics: this set of lectures being specifically concerned with neural aspects - linking the hum		
technology.	,		
XP14MEN	New Trends in Converter Technology	ZK	4
	to introduce students to the principles and functions of latest topologies of power semiconductor electric energy converters, t		
	at of the subject is the optimization of the power conversion parameters in power semiconductor converter systems. The subject		-
	ples, topologies, functions and possibilities of application of power semiconductor converters realized on the basis of modern furful control microcomputers. The topics are focused on pulse width modulation methods for voltage and current control, mod	•	
	e control of the current curve and the voltage curve, as well as the overall quality of electric energy transmission. The probler	-	
matrix converters, multi	level converters, resonant converters as well as problems related to their practical use are also solved.		
XP14APR	New Trends in Electric Device Apply	ZK	3
XP14TPR	New Trends in Electric Device Theory	ZK	3
XEP33NUM	Numerical Analysis	Z,ZK	4
	o basic numerical methods of interpolation and approximation of functions, numerical differentiations and integration, solution Equations and systems of linear equations. Emphasis is put on estimation of errors , practical skills with the methods and demi		
Maple and computer gra		Justiation of their	properties using
XP33NUM	Numerical Analysis	Z,ZK	4
	o basic numerical methods of interpolation and approximation of functions, numerical differentiation and integration, solution	,	
	tions and systems of linear equations. Emphasis is put on estimation of errors, practical skills with the methods and demonst	ration of their pro	perties using
Maple and computer gra		717	
XP01NLA	Numerical Linear Algebra bra. Norms of vectors and matrices. Numerical linear algebra. Special systems. Eigenvalues and eigenvectors. Iterative meth	ZK	ion Singular
	bia. Norms of vectors and matrices. Numerical linear algebra. Special systems. Eigenvalues and eigenvectors, iterative metri eneralized solutions of linear systems.	lous. Matrix irrvers	ion. Singulai
XP32NMR	Numerical Methodes of Electromagnetic Tasks Solution	ZK	4
	nalysis of electromagnetic field distribution through both air and other environment. It offers a view deep inside to popular nume	erical methods as	Finite Difference
	nent Method and Finite Element Method. Handling the software is obvious nowadays; nevertheless, the mayor attention is paid to	o understanding t	he mathematical
	apparatus and understanding the physical principles of the solved tasks in symbiosis to particular used software.	71/	4
XP17NME	Numerical Methods in Electromagnetic Field	ZK	4 hnique Point
	r and wave equations. Analytical, semianalytical, seminumerical and numerical methods. Matrix equations and algorithms: M od of Moments, Multiple MultiPoles, Boundary Element Method, Finite Difference Method, Finite Element Method, Finite Integi	_	
_	ions: direct methods, Gauss-JordanOs elimination, pivotation, LU-decomposition, banded and sparse matrix, conjugate-grac		,

XP35OFD	Estimation and Filtering	ZK	4
	nt design, structure selection and parameter estimation. Bayesian approach to uncertainty description. Posterior probability der	·=	
	Robust numerical implementation of least squares estimation for Gaussian distribution. Parameter estimation and state filteri	ng - Bayesian ap	proach. Kalman
	perties of Kalman filter. Kalman filter for colored/correlated noise.	ZK	4
XP37ODS	Optical Design and Simulation	ZK	4
XP17OV	Optical Fibers bers, attenuation and dispersion, step-index fibers, gradient fibers, single and f1ibers, optical cables, splices and connectors,		•
	enomena in optical, fibers, fibers for sensors.	optical libers life	asurements,
XP36PSV	Parallel Systems and Algorithms	ZK	4
Complexity measures a	nd scalability of parallel algorithms. Parallel computer architectures, models, PRAM, APRAM. Direct and indirect interconnect		beddings,
	ation algorithms - routing, switching techniques, deadlock problem, permutation routing, collective communication operations.		ŭ
	station, Euler tour technique. Parallel sorting. Parallel linear algebra algorithms. Parallel combinatorial search. Parallel complexity	theory Graduate	s of engineering
XP01PDR	Computer Science and Informatics FEE CTU cannot register. Partial Differential Equations	ZK	4
	rential equations of mathematical physics. Initial and boundary value problems. The method of characteristic functions, integra	ı	•
XP34PED	Advanced Electronic Devices	ZK	4
	g. Quantum well, wire, point. 2D electron gas based devices (HEMT, MOD FET). Devices based on resonance double-barrier to	ınnelling. 3D strud	ctures. Quantum
	mories, generators, multipliers). Heterogeneous structures. Microwave devices, HBT, Gunn diodes. Microwave device application	tions. Heterogene	ous devices
	oling. Cryotronic devices. Recording media. IC development trends.		
XP13PED	Plastics in Electrical Engineering	Z,ZK	4
	ectrical manufacturing. Exercise plastics in the production of the cables, structural members etc. The specialty requirements on tl shape constancy). Composite materials from out plastics. Technology treatment of plastics. Degradation of plastics impact of	•	` '
	hemical resistance). The plastic waste. Recycling of plastics. Impact of production and the used up plastics on the environme		
XP02PT	Plasma Technologies	ZK	4
XEP36AGT	Advanced Computational Game Theory	ZK	4
XP39PMV	Advanced Methods of Visualization	ZK	4
	ased on physical models. Scientific visualization and volume rendering. Volume graphics. Information visualization. Interaction		alization
	risualization in WWW environment. Particle models and visualization of technological processes. Computational fluid dynamic		
XP36POA	Advanced Parallel Algorithms	ZK	4
	ime-, and cost-efficient PRAM algorithms and parallel algorithms for distributed memory machines. The collection of algorithr tted list ranking, Cole's MergeSort, optimal mesh sort, connected components, tree contraction and tree evaluation, pattern n		inced parallel
XP34SRS	Semiconductor Radiation Sources	ZK	4
	semiconductors. Homogeneous and heterogeneous junction, double heterostructure lasers and LEDs. Non-coherent LED's, s		
Electromagnetic fields in	n semiconductor lasers. Types of lasers and their properties. Waveguide lasers, DFB and BFR structures. SQW and MQW las	ers, quantum we	lls. Tunable
	line width and line stability. Radiating characteristic, coupling of the radiation source to a waveguide. Bi-stable and memory elements of the radiation source in the stability.		. Semiconductor
XEP33SAM	plifiers and wave convertors. Lasers and non-coherent diodes for optical communications. Measurement methods, application	ns. ZK	4
	Understanding State of the Art Methods, Algorithms, and Implementations tudents will study selected sophisticated state of the art methods that have an efficient implementation publically available. The	ı	•
	successfully used in a number of applications. The goal for the students is to understand the method, to understand the imple		-
	tool to solve other problems. The course will include two strands. The first strand will be similar to a reading group - the stude		
	typically a published paper. In the second, practical component of the course, the students will use an implementation of the course,	discussed method	ls to solve some
particular task.	Described Data Mining Droblems	71/	4
XP33PPD The course is focused or	Practical Data Mining Problems n solving of practical data mining problems. Lectures deal with data transformation, pre-processing and verification, selection of	ZK	4
	s evaluation and results interpretation. The attention is paid to solving of an individual data mining problem based on real-life		
lecturer.		•	
XP33PAD	Probabilistic Algorithms	ZK	2
	s of statistic and probability. An analysis of the notion of non-deterministic algorithm. Effectivity criteria for non-deterministic a	_	
· -	is. The probability of failure. Loss function. The expected risk. Probabilistic analysis of deterministic algorithms. Criteria for appl	ication of probabi	listic algorithms.
XP33PMD	and their practical importance. Probabilistic Models of Uncertainty in AI	ZK	4
	ity. Foundations of graph theory. Triangulated graphs and their characteristics. Information as a measure of dependence. Conditi		
	lence Lemma). Knowledge representation by multidimensional distributions. Qualitative knowledge represented by dependen		
models and Bayesain ne	etworks. Decomposable models for computation in Graphical Markov models. Examples of application.		
XP37PKP	Biomedical Engineering in Clinical Practice	ZK	4
-	tical problems that a biomedical engineer has to overcome in the clinical practice. Position of BME in research and in the clinic	-	
· ·	· - design, conducting and evaluation, statistical analysis used in medicine. Thermodynamics of gas mixtures. Humidification on Inces. Systems with compressible fluids. Measurement of physical parameters in rigid and compliant systems. Basic parts of pr	_	
	of airflow and pressure, gas blenders, etc.). Modelling and analysis of biological systems using electrical analogy, practical app		-
-	biochemical sensors. Haematology analysers. Interference, corrections of measured values, standardisation in medicine. Ele	-	-
	ectrodes and circuits for biopotential measurement and electrical stimulation. Indirect measuring methods of biological and p	hysical values.	
XP36PAS	Algebraic Specifications Prototyping	ZK	4
- ·	syntax and semantics of a specification language (OBJ3), structured specifications, generic specifications, implementation of og, translation into Lisp, term rewriting systems, abstract rewriting machine, prototyping of a specification, prototyping in OBJ3, c		
(C++).	og, aanotaaon into Etop, territ rewriting systems, abstract rewriting machine, prototyping of a specification, prototyping in ODJS, t	onversion to pluc	cadiai language
XP33PAM	Industrial application of multi-agent systems	ZK	4
XP13PSD	Flexible Production Systems	Z,ZK	4
	utomation. Flexible automation. Basic components of FMS. Machining centres, flexible manufacturing cells and islands. Optic		•
	components. Interfaces. Systems of automatical self checking of quality. CNC machines appropriate for FMS. Manipulators an		
ะเพธ. Iransport and its o	control. CNC for the control of FMS. Flexible assembling systems. Automated plants of future, conception and tasks. Efficiency	y ot FMS. Persona	ai problems.

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XP15SPS Coupled Problems in Heavy Current and Power Engineering Z,ZK 4 Concept of a coupled problem, classification of the coupled problems typical for heavy cur-rent and power applications. Mathematical description of the relevant physical fields, links between corresponding partial differential equations. Characteristics of electromagnetic-thermal problems (with respecting eventual thermoelasticity), electromagnetic-thermal-hydrodynamic and electromagnetic-mechanical problems and also problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of their mathematical and computer models and algorithms of their solution. Information about available SW, its existing capabilities and perspectives. XEP33VKR Selected Topics in Pattern Recognition and Computer Vision The course deals with fundamental results from computer vision and pattern recognition. The course treats selected key results, as well as latest areas of research, especially those which substantially influence the development in the subject field. Education is performed in the form of a reading group. The course is mainly targeting PhD candidates, but is also	XP32RTS Telecommunications Syservices provided. XP15RE Objective functions of petasks. System state estire reactive powers balance	Consensus and synchronization of linear/nonlinear, continuous/discrete-time systems, Cooperative stability, optimality and roby, Interactions with environment. Telecommunications Systems Management stems Management is a discipline which deals problems of interactions of technical and business aspects of management of Control of Power Systems Over system control, feasibility and algorithms of optimization methods, handling of constrain conditions. Hierarchy and deconation. Load forecasting and load curve civering. Unit commitment. Optimization of operation with respect to net topology co. Control of frequency and active powers balance. Optimal power flow. Dynamical models of power stations and systems. Solubsidiary services.	ZK telecommunicati Z,ZK mposition of systenstrains.Control oution of extraordin	ory, Distributed ted optimization: 4 on networks and 4 em controlling of voltage and nary states
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between corresponding partial differential equations. Characteristics of electromagnetic-thermal problems (with respecting eventual thermoelasticity), electromagnetic-thermal-hydrodynamic and electromagnetic-mechanical problems and also problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of their mathematical and computer models and algorithms of their solution. Information about available SW, its existing capabilities and perspectives. XEP33VKR Selected Topics in Pattern Recognition and Computer Vision ZK 4 The course deals with fundamental results from computer vision and pattern recognition. The course treats selected key results, as well as latest areas of research, especially those which substantially influence the development in the subject field. Education is performed in the form of a reading group. The course is mainly targeting PhD candidates, but is also	XP32RTS Telecommunications Syservices provided. XP15RE Objective functions of potasks. System state estimates reactive powers balance Dispatch, system and state and s	Consensus and synchronization of linear/nonlinear, continuous/discrete-time systems, Cooperative stability, optimality and roby, Interactions with environment. Telecommunications Systems Management stems Management is a discipline which deals problems of interactions of technical and business aspects of management of Control of Power Systems Over S	ZK telecommunicati Z,ZK mposition of systemstrains.Control of ution of extraordin ZK	ory, Distributed ted optimization: 4 on networks and 4 em controlling of voltage and nary states
and electromagnetic-mechanical problems and also problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of their mathematical and computer models and algorithms of their solution. Information about available SW, its existing capabilities and perspectives. XEP33VKR Selected Topics in Pattern Recognition and Computer Vision ZK 4 The course deals with fundamental results from computer vision and pattern recognition. The course treats selected key results, as well as latest areas of research, especially those which substantially influence the development in the subject field. Education is performed in the form of a reading group. The course is mainly targeting PhD candidates, but is also	XP32RTS Telecommunications Syservices provided. XP15RE Objective functions of potasks. System state estimates reactive powers balance Dispatch, system and state and s	Consensus and synchronization of linear/nonlinear, continuous/discrete-time systems, Cooperative stability, optimality and roby, Interactions with environment. Telecommunications Systems Management stems Management is a discipline which deals problems of interactions of technical and business aspects of management of Control of Power Systems Every system control, feasibility and algorithms of optimization methods, handling of constrain conditions. Hierarchy and decondation. Load forecasting and load curve civering. Unit commitment. Optimization of operation with respect to net topology concentrol of frequency and active powers balance. Optimal power flow. Dynamical models of power stations and systems. Solubsidiary services. Scientific Writing to help researchers organize and effectively communicate, in English, their scientific results. While the instructor is an Electrical disciplines.	ZK telecommunicati Z,ZK mposition of systemstrains.Control of ution of extraordin ZK cal Engineer, the	ory, Distributed ted optimization: 4 on networks and 4 em controlling of voltage and hary states 4 approaches are
models and algorithms of their solution. Information about available SW, its existing capabilities and perspectives. XEP33VKR Selected Topics in Pattern Recognition and Computer Vision ZK 4 The course deals with fundamental results from computer vision and pattern recognition. The course treats selected key results, as well as latest areas of research, especially those which substantially influence the development in the subject field. Education is performed in the form of a reading group. The course is mainly targeting PhD candidates, but is also	XP32RTS Telecommunications Syservices provided. XP15RE Objective functions of potasks. System state estime reactive powers balance Dispatch, system and suxEP17SWR This course is intended applicable to all technical XP15SPS	Consensus and synchronization of linear/nonlinear, continuous/discrete-time systems, Cooperative stability, optimality and roby, Interactions with environment. Telecommunications Systems Management stems Management is a discipline which deals problems of interactions of technical and business aspects of management of Control of Power Systems Every system control, feasibility and algorithms of optimization methods, handling of constrain conditions. Hierarchy and decondation. Load forecasting and load curve civering. Unit commitment. Optimization of operation with respect to net topology concentration. Control of frequency and active powers balance. Optimal power flow. Dynamical models of power stations and systems. Solubsidiary services. Scientific Writing to help researchers organize and effectively communicate, in English, their scientific results. While the instructor is an Electrical disciplines. Coupled Problems in Heavy Current and Power Engineering	ZK telecommunicati Z,ZK mposition of systenstrains.Control cution of extraordin ZK cal Engineer, the	ory, Distributed ted optimization: 4 on networks and 4 em controlling of voltage and harry states 4 approaches are
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which substantially influence the development in the subject field. Education is performed in the form of a reading group. The course is mainly targeting PhD candidates, but is also	XP32RTS Telecommunications Syservices provided. XP15RE Objective functions of potasks. System state estime reactive powers balance Dispatch, system and suxEP17SWR This course is intended applicable to all technications XP15SPS Concept of a coupled probetween corresponding pand electromagnetic-metals.	Consensus and synchronization of linear/nonlinear, continuous/discrete-time systems, Cooperative stability, optimality and roby, Interactions with environment. Telecommunications Systems Management stems Management is a discipline which deals problems of interactions of technical and business aspects of management of the cooperation of Power Systems of potential disciplines of optimization methods, handling of constrain conditions. Hierarchy and decomption and load curve civering. Unit commitment. Optimization of operation with respect to net topology concounts of frequency and active powers balance. Optimal power flow. Dynamical models of power stations and systems. Solubsidiary services. Scientific Writing to help researchers organize and effectively communicate, in English, their scientific results. While the instructor is an Electrical disciplines. Coupled Problems in Heavy Current and Power Engineering oblem, classification of the coupled problems typical for heavy current and power applications. Mathematical description of the coupled problems typical for heavy current and power applications. Mathematical description of the coupled problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of the chanical problems and also problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of the chanical problems and also problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of the coupled problems and also problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of the coupled problems and also problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of the electromagnetic field and electric circuits.	ZK telecommunicati Z,ZK mposition of systemstrains.Control cution of extraordin ZK cal Engineer, the Z,ZK the relevant physitromagnetic-therm	ory, Distributed ted optimization: 4 on networks and 4 em controlling of voltage and harry states 4 approaches are 4 cal fields, links al-hydrodynamic
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available for Msc students with strong interest, possibly experience too, on a research topic that is relevant to the course.	XP32RTS Telecommunications Syservices provided. XP15RE Objective functions of potasks. System state estimates are reactive powers balance Dispatch, system and sustained applicable to all technical XP15SPS Concept of a coupled probetween corresponding pand electromagnetic-memodels and algorithms of XEP33VKR	Consensus and synchronization of linear/nonlinear, continuous/discrete-time systems, Cooperative stability, optimality and roby, Interactions with environment. Telecommunications Systems Management stems Management is a discipline which deals problems of interactions of technical and business aspects of management of Control of Power Systems Over system control, feasibility and algorithms of optimization methods, handling of constrain conditions. Hierarchy and deconation. Load forecasting and load curve civering. Unit commitment. Optimization of operation with respect to net topology concontrol of frequency and active powers balance. Optimal power flow. Dynamical models of power stations and systems. Soliabsidiary services. Scientific Writing To help researchers organize and effectively communicate, in English, their scientific results. While the instructor is an Electrical disciplines. Coupled Problems in Heavy Current and Power Engineering To help researchers of the coupled problems typical for heavy current and power applications. Mathematical description of the cartial differential equations. Characteristics of electromagnetic-thermal problems (with respecting eventual thermoelasticity), electromagnetical problems and also problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of their solution. Information about available SW, its existing capabilities and perspectives. Selected Topics in Pattern Recognition and Computer Vision	ZK telecommunicati Z,ZK mposition of systemstrains.Control of cution of extraordin ZK cal Engineer, the Z,ZK the relevant physitromagnetic-therm of their mathematic	ory, Distributed ted optimization: 4 on networks and 4 em controlling of voltage and harry states 4 approaches are 4 cal fields, links al-hydrodynamic al and computer
	XP32RTS Telecommunications Syservices provided. XP15RE Objective functions of potasks. System state estimates are reactive powers balance Dispatch, system and sustained applicable to all technical XP15SPS Concept of a coupled probetween corresponding pand electromagnetic-memodels and algorithms of XEP33VKR The course deals with further the course deals with the cou	Consensus and synchronization of linear/nonlinear, continuous/discrete-time systems, Cooperative stability, optimality and roby, Interactions with environment. Telecommunications Systems Management stems Management is a discipline which deals problems of interactions of technical and business aspects of management of Control of Power Systems over system control, feasibility and algorithms of optimization methods, handling of constrain conditions. Hierarchy and deconation. Load forecasting and load curve civering. Unit commitment. Optimization of operation with respect to net topology concontrol of frequency and active powers balance. Optimal power flow. Dynamical models of power stations and systems. Solibisidiary services. Scientific Writing It disciplines. Coupled Problems in Heavy Current and Power Engineering Toologlem, classification of the coupled problems typical for heavy current and power applications. Mathematical description of the artial differential equations. Characteristics of electromagnetic-thermal problems (with respecting eventual thermoelasticity), elect chanical problems and also problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of their solution. Information about available SW, its existing capabilities and perspectives. Selected Topics in Pattern Recognition and Computer Vision Indiamental results from computer vision and pattern recognition. The course treats selected key results, as well as latest are the development in the subject field. Education is performed in the form of a reading group. The course is mainly targetic entered the development in the subject field. Education is performed in the form of a reading group. The course is mainly targetic.	ZK telecommunication Z,ZK mposition of systemstrains.Control of cution of extraordin ZK cal Engineer, the Z,ZK the relevant physitromagnetic-therm of their mathematic ZK eas of research, e	ory, Distributed ted optimization: 4 on networks and 4 em controlling of voltage and harry states 4 approaches are 4 cal fields, links al-hydrodynamic al and computer 4 specially those
	XP32RTS Telecommunications Syservices provided. XP15RE Objective functions of potasks. System state estimates are reactive powers balance Dispatch, system and sustained applicable to all technical XP15SPS Concept of a coupled probetween corresponding pand electromagnetic-memodels and algorithms of XEP33VKR The course deals with further the course deals with the cou	Consensus and synchronization of linear/nonlinear, continuous/discrete-time systems, Cooperative stability, optimality and roby, Interactions with environment. Telecommunications Systems Management stems Management is a discipline which deals problems of interactions of technical and business aspects of management of Control of Power Systems over system control, feasibility and algorithms of optimization methods, handling of constrain conditions. Hierarchy and deconation. Load forecasting and load curve civering. Unit commitment. Optimization of operation with respect to net topology concontrol of frequency and active powers balance. Optimal power flow. Dynamical models of power stations and systems. Solibisidiary services. Scientific Writing It disciplines. Coupled Problems in Heavy Current and Power Engineering Toologlem, classification of the coupled problems typical for heavy current and power applications. Mathematical description of the artial differential equations. Characteristics of electromagnetic-thermal problems (with respecting eventual thermoelasticity), elect chanical problems and also problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of their solution. Information about available SW, its existing capabilities and perspectives. Selected Topics in Pattern Recognition and Computer Vision Indiamental results from computer vision and pattern recognition. The course treats selected key results, as well as latest are the development in the subject field. Education is performed in the form of a reading group. The course is mainly targetic entered the development in the subject field. Education is performed in the form of a reading group. The course is mainly targetic.	ZK telecommunication Z,ZK mposition of systemstrains.Control of cution of extraordin ZK cal Engineer, the Z,ZK the relevant physitromagnetic-therm of their mathematic ZK eas of research, e	ory, Distributed ted optimization: 4 on networks and 4 em controlling of voltage and harry states 4 approaches are 4 cal fields, links al-hydrodynamic al and computer 4 specially those

XP01SPJ	Syntax and semantics of a formal language	ZK	4
	of a formal language. A simple imperative language, assignment command. Denotational and operational semantics, coheren	1	ematical domain
	unctionals, recursive definitions. Lambda - notation. A simple functionl language, denotational semantics. New functions define		constructions.
•	Other approaches to semantics, continuation semantics. Axiomatic (Hoare's) semantics. Expressive power of a programming		
XP39SPG	Computer Graphics Seminar seminar will cover selected research topics in computer graphics such as efficient rendering techniques, modeling of surface m	Z,ZK	4
	enomena, geometrical modeling and animation. In the seminar we will also discuss computer graphics techniques used in re		
	puter vision and human computer interaction based on the particular topics of PhD theses of the participating students. The		
the selected topics to the	ne students and by analyzing selected highly influential research publications to further develop the research capabilities of the	he students.	
XP36SEP	Seminars on Architectures of Parallel Computers	ZK	4
	es of high-performance computers and trends in technologies. Memory coherence and sequential consistency models. Share	-	
· '	d cache coherence protocols and synchronization mechanisms. Virtual shared memory architectures: distributed cache-cohe Clusters: fast communication networks and protocols.	erence protocols.	Synchronization
XP38SSB	Sensors and Buses	ZK	4
	duced into the advanced topics of engineering sensors and sensor networks. Topics include: Sensor applications, physical prin	1	
parameters, the concep	t of smart sensors, measurement systems, analog circuits for sensor signal processing, sensor error correction, calibration and	diagnostics, noise	and disturbance
immunity.			
XP13SID	Software in Industrial Engineering	Z,ZK	4
1	IBM compatible personal computers, their architecture. Using of application programs for mathematics, graphics, text process roduction to user interface based on Microsoft Windows.	sing, database and	I CAD, examples
XP13SSD	Special Methods of Devices Quality Evaluation	Z,ZK	4
	incipal values determining the quality of the passive and active devices. Measuring methods, their evaluation, identification o	1 '	
1	p ports parameters of the device. Matching of the device to the measuring circuit. The noise of the electronic circuits, optimal	-	
	ear" circuits, intermodulation distortion, measuring of the non-linearity and intermodulations.		
XP37SRP	Radio Receivers Special Technology	ZK	4
	d radio receivers technology. Basic structure classical and modern software defined radio receivers. Technical parameters ra elevision receivers. Professional radiocommunication receivers and transceivers. Diversity techniques. Spread spectrum radio	•	
	elevision receivers. Professional radiocommunication receivers and transceivers. Diversity techniques, Spread spectrum radio ers. Oscillators and frequency synthesizers. Mixers and demodulators. Radio receivers system design.	o receivers. Low in	oise namowband
XP02SF	Statistical Physics	Z,ZK	4
	o the fundamentals of statistical physics. It is the third part of four-part lecture cycle.	,	
XP37SZS	Statistical Signal Processing	Z,ZK	4
	nd detection theory. General properties and fundamental limits. ML, LS, Bayes (MAP,MSE), NP, MM estimators and detector	s. Adaptive filter th	eory (Kalman,
	n and parameter estimation.	717	
XP16STV	Product Strategy	ZK	4 Product
	licy, pricing and contractation policy, communication, distribution. Marketing mix. Inovations. Concepts of marketing strategy. egic marketing simulation Markstrat.	Reverse marketing	g. Product
XP36STR	Stringology	ZK	4
	nd sequences. General, ordered alphabet. Generalized and weighted strings. Finite and infinite alphabet. Searching in text, d	lictionaries and lar	nguages. Exact
1	ng. Forward and backward matching. Searching in compressed text. Searching in more-dimensional text. Searching for longest c	ommon factors and	d subsequences.
	es in text. Construction of covering of text. Representation of text, prefix, suffix and factor automata, suffix trees and arrays.	71/	4
XEP33SML	Structured Model Learning learning learning selearning course learning course covers learning and parameter estimation for structured models like Markov Random Fields, Belief Networl	ZK	4 Neen Neural
Networks.	realiting course covers learning and parameter estimation for structured models like Markov Italiuom Fielus, belief Network	ks and (stochastic) Deep Nediai
XP34STV	VLSI Structures and Technologies	ZK	4
	the IC's. Bipolar and unipolar structures. BiCMOS structures. 3D structures. Sub-micron structures. Memory structures. Test		SI technological
-	emiconductor technology. IC design, design of technology. Design rules. Reliability, yield. Outlooks and limitations of IC devel		
XP15ZSS	Light sources and Equipment	Z,ZK	4
XP33SCD	Man-Machine Systems	ZK	4
1	systems development. Human operator tasks. Manual control, supervisory control cognitive control. Typical structure of a contration and machine. Control levels after Rasmussen. Skill based, role based and knowledge based operator behavior models.	-	
	ental models. Human-machine interaction. Intelligent interface. Factors influencing operator behavior. Stress. Mental load. Hu	•	·
1 ' ' ' '	nachine systems simulators. User-centered system design.		
XP38SYS	Measurement and Data Acquisition Systems	ZK	4
The subject introduces	the principles and technical means of data acquisition in the laboratory and industrial environment. Attention is paid to both I	hardware and soft	ware aspects of
	ms for data acquisition and process control. Laboratory exercises are designed in part in the form of classical tasks, partly in	the form of proble	m-oriented tasks
	ing of automated measurement systems and control of measurement processes.	7.71/	4
XP13SRD	Real Time Systems for Process Control real time systems. State transition diagram of real time systems. Semaphore and de	Z,ZK	4 Pal time systems
in control of technologic		saulock. Osling of h	ear time systems
XP13SJD	Quality Control Systems	Z,ZK	4
The concept of quality a	and reliability. Basic quality management systems. ISO 9000, TQM, Kaizen. Basic characteristics of ISO 9000. Quality manua	1	ctor experiments
	Mathematical model based on factor experiments. Optimization of mathematical model. Six Sigma quality management syst	•	
_	system. Reliability as a subset of quality. Mathematical distributions used in the field of reliability. Usage and maintenance coe	ептісіent. Backup -	types and
XP04S1ZK	on. Accelerated reliability testing. Processing and analysis of experimental data.	ZK	0
XP04S1ZK XP04S1	Spanish language 1 Spanish language 1	NIC	0
	Spanish language । edge of Spanish language, including the language for specific purposes.Specific technical style characteristics focused on sp	1	
_	esentations, understanding the text-all based on intermediate level language.		
XP04S2ZK	Spanish language 2	ZK	0
XP04S2	Spanish language 2	NIC	0
	stening, understanding a Spanish text of cca 120 pages, writing, speaking). The skills are practiced on writing letters, present		and oral,news
etc. Individual home pre	eparation is necessary. Materials are chosen with regards to the study field of a postgraduate. High-level and fluent speech is	s demanded.	

XP37TMP Medical Instrumentation	ZK	4
The subject deals with principles and properties of medical systems for analysis of body fluids, blood gas analysis, medical minors of basic life funct	ions (ECG, pulse d	oxymetry EEG.
etc.), thermodynamic principles of anaesthetic equipment and equipment for artificial lung ventilation, haematological analysers and other medical a		,,,
		4
XP13TND Technology of Low Temperatures and Superconductivity	Z,ZK	4
Thermodynamic principles of cooling. Equipments for achievement of low temperatures, liquifiing of gases. Ultralow temperatures. Properties of isoto	•	•
Physical properties of solids at low temperatures. Principles of superconductivity theory, transport currents, stability of superconductivity state, weak		
phenomena. Properties and technology of metallic and high temperature superconductors. Thermal insulation of low temperature equipments. Low temperature superconductors and technology of metallic and high temperature superconductors.	perature thermome	try. Accessories
and work in low temperature laboratory. The use of low temperature technology in practice.		
XP17TVC Technique of Highly Sensitive Receivers	ZK	4
Design of highly sensitive microwave receivers, mm - wave and submm - wave receivers. Electromagnetic spectrum and noise properties of the Ear	1	
Microwave, millimetre wave communication. Semiconductors for microwave and millimetre wave bands, SIS detectors, mixers, infrared receivers. High		
measurement of noise parameters. Multispectral radiometry and remote sensing, electromagnetic radiation - interference, EMC theory and measure		tors teermology,
XP13TMD Technological Aspects of Microcomputer Design	Z,ZK	4
Industrial microcomputers, modular design and hardware solution. The data storage technology. The data storage media. The device protection again	inst environmental	influence. The
cooling and air condition of equipments. The human machine interface - input and output devices. The ergonomic design of microcomputers and specific	ecial devices. The	quality of
microcomputer systems, criteria. The quality control of design and services, the quality of software. The legal aspects of microcomputer use. The control of design and services, the quality of software.	ntemporary trends	in industrial
microcomputers.		
XP13TPD Technological Processes in Electronic Manufacturing	Z,ZK	4
		•
Development of technology of packaging. Contemporary methods of packaging of components SOP, DIP, SIP, ZIP, QFP and others, properties, advan		
of packages from the viewpoint of environmental resistivity. Classification of multichip modules. Multichip modules of different types: MCM-L, MCM-C		
multichip modules. Technology of contacting og dies. Electrical design of MCMs. Thermal design of MCMs. Physical design of MCMs. Parameters for	r evaluation of MC	Ms. Reliability
of MCMs. Design tools. Programmable modules. Applications of MCMs.		
XP34TOS Technology of Optical Devices	ZK	4
Preparation of optoelectronic materials and structures. Diagnostic and testing methods. Design and preparation of double heterostructures. Preparation of double heterostructures.	1	tor waveguides
Preparation of LED's, lasers, photo-resistors. Preparation of QW structures. Design of dielectric waveguide structures. Preparation of dielectric wave		- 1
	-	-
preparation of optical radiation distributing structures. Design and preparation of optical radiation control structures. Measurement methods. Testing me	tnods. Examples o	rsemiconductor
structures. Examples of dielectric structures.		
XP37TEA Theoretical Eletroacoustics	Z,ZK	4
Vibrating systems in fluids and solids. Systems of lumped and distributed parameters in solids. Equivalent circuits of membranes and plates. Recipro	cal transducers wit	th magnetic and
electric field. Non-reciprocal transducers (opto and thermoacoustical transducers, piezoresistive transducer). Electromechanical and electroacoustic		-
distributed elements. Radiation, radiation impedance. Acoustic transmitters, directivity. Acoustic receivers. Acoustical systems with lumped and distribute		
	ca cicinonia. 7 ioda	olic wavegulacs,
air-gaps. Coupled systems.		
XP02TF1 Theoretical Physics 1	Z,ZK	4
The lecture Theoretical Physics 1 is a basis for the following lectures of theoretical physics for the doctoral study. The main aim is theoretical Mechan	nics - to master the	description of
motion in curvilinear coordinates.		
VD00TF0 Theoretical Dhysics 2		
APUZTEZ Theoretical Physics Z	Z.ZK	4
XP02TF2 Theoretical Physics 2 The lecture is devoted to the fundamentals of quantum physics in Dirac formalism. It is the second part of four-part lecture cycle.	Z,ZK	4
The lecture is devoted to the fundamentals of quantum physics in Dirac formalism. It is the second part of four-part lecture cycle.		
The lecture is devoted to the fundamentals of quantum physics in Dirac formalism. It is the second part of four-part lecture cycle. XP37TAS Acoustic signal processing and theory	Z,ZK	4
The lecture is devoted to the fundamentals of quantum physics in Dirac formalism. It is the second part of four-part lecture cycle. XP37TAS Acoustic signal processing and theory Acoustic signal classification, sources, description of properties. Statistical analysis of acoustic signals. Spectral analysis of signals, Fourier transform	Z,ZK m application. Time	4 e-frequency
The lecture is devoted to the fundamentals of quantum physics in Dirac formalism. It is the second part of four-part lecture cycle. XP37TAS Acoustic signal processing and theory	Z,ZK m application. Time	4 e-frequency
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XP02UZ	Ultrasound and Quantum Acoustics	ZK	4
The purpose of these le	ectures is to familiarize doctoral students with the issues of ultrasonic waves needed for the design of a wide range of ultrason	nic devices and to	discuss in detail
•	ral student could use in his work. The subject of the offer is a range of classic and recently developed findings from research		
XP33UID	Artificial Intelligence	ZK	4
_	sues. Knowledge representation: production systems, predicate logics, semantic nets, frames, and scenarios. Problem solving		-
	e search algorithms. Expert systems for diagnostics and planning tasks. Uncertainty processing. Hajek's algebraic theory. Creation om examples. Distributed expert systems with the blackboard architecture, multi-agent systems. Backgrounds of pattern recc	_	ases. Knowledge
XP01UAG	Introduction to Algebraic Geometry	ZK	4
	olution sets of systems of polynomial equations in more than one variable and their relationship with the ideals in polynomial		•
	er's bases and their properties, Buchberger's algorithm for searching a Groebner's basis, elimination theory, Hilbert's Nullstel	•	
varieties and radicals.		, , , , , , , , , , , , , , , , , , , ,	
XP02UFL	Introduction to Laser Physics	ZK	4
The subject introduces	the basics of laser physics. It explains the principle of laser operation, presents basic terms and describes in detail individual	types of lasers, ir	cluding their
	izes the main properties of laser radiation and briefly indicates the possibilities of creating short pulses of radiation. The next	-	
	nan activity. It also lists safety principles for working with lasers. In the practical part, it is supplemented by visits to top workpl	aces (e.g. PALS, E	ELI, HILASE)
dealing with the given is		717	
XP01UNA	An introduction to nonassociative algebras	ZK	4
	e theory of nonassociative algebra. We introduce the otions of free nonassociative algebra, tensor algebra, bimodules and ire tention on the ariety of alternative algebras and composition algebras. We define Lie, alcev and Jordan algebras, their univer		_
XP01USA	An introduction to superalgebras.	ZK	4
	⊨An introduction to superalgebras. Heory of superalgebras. We introduce notions of a graded algebra, superalgebra, Grassmann envelope of a superalgebra. C	1	= = = = = = = = = = = = = = = = = = = =
	lgebras. We pay a big attention on the variety of alternative and Jordan superalgebras.	onoider varioties (or ouperalgebrae
XP15UEE	Electric Energy Use and Conservation	Z,ZK	4
XP13VTK	Vacuum technology and cryogenics	Z,ZK	4
	processes. Surface processes. Processes circulative to wall. Vacuum pumps. Measurements in vacuum techniques. Princ		•
-	achievement of low temperatures. Properties and behavior of matters at low temperatures. Transport of heat and insulating sy		
temperature thermome	try.Laboratory training and seminars are focused to obtain a basic practical proficiencies and the other knowledges in vacuur	n technology and	cryogenics.
XP37VRA	Research Seminars in Radioelectronics and Acoustics	Z,ZK	4
The course is intended	for PhD students of the radioelectronics and acoustics specialization. It develops the presentation skills and serves as a platt	form for discussion	and defence of
students' research resu	ılts.		
XP39VR	Virtual reality	ZK	4
	he VRML language. Standard and non-standard extensions to the VRML language. Programming of external applications wit	h EAI interface. M	ulti-user virtual
	tion in virtual environment. Hardware and software support for virtual reality systems. QuickTime VR. Specification X3D.	7 716	
XP02VNP	Plasma Waves and Instabilities will be introduced in the first part of the lecture (dispersion relation, phase and group velocities, Fourier analysis). Fundame	Z,ZK	4
i Basic wave bhenomena			
will be derived from the	linearized MHD equations (magnetoacoustic waves - Alfven, F and S wave; electromagnetic waves in plasma - O, X, R, L was		
will be derived from the part of the lecture will be	linearized MHD equations (magnetoacoustic waves - Alfven, F and S wave; electromagnetic waves in plasma - O, X, R, L was de devoted to final size waves, nonlinear phenomena (Landau damping) and solitons in plasma.	ave, CMA diagram). The second
will be derived from the part of the lecture will be XP16DEL	linearized MHD equations (magnetoacoustic waves - Alfven, F and S wave; electromagnetic waves in plasma - O, X, R, L wave devoted to final size waves, nonlinear phenomena (Landau damping) and solitons in plasma. History of technology and economic	ave, CMA diagram	i). The second
will be derived from the part of the lecture will be XP16DEL XP37VKF	linearized MHD equations (magnetoacoustic waves - Alfven, F and S wave; electromagnetic waves in plasma - O, X, R, L wave devoted to final size waves, nonlinear phenomena (Landau damping) and solitons in plasma. History of technology and economic Selected Parts from Photonics	ave, CMA diagram	2 4
will be derived from the part of the lecture will be XP16DEL XP37VKF Anatomy and physiological will be a second to the part of	linearized MHD equations (magnetoacoustic waves - Alfven, F and S wave; electromagnetic waves in plasma - O, X, R, L wave devoted to final size waves, nonlinear phenomena (Landau damping) and solitons in plasma. History of technology and economic Selected Parts from Photonics by of vision. Integral photonic sensors. Panoramatic (image) photonic sensors. Integral photonic displays. Panoramatic photonic	ZK ZK cit displays. Electro	2 4 on optics. Image
will be derived from the part of the lecture will be XP16DEL XP37VKF Anatomy and physiologiconverters. Special pho	linearized MHD equations (magnetoacoustic waves - Alfven, F and S wave; electromagnetic waves in plasma - O, X, R, L wave devoted to final size waves, nonlinear phenomena (Landau damping) and solitons in plasma. History of technology and economic Selected Parts from Photonics by of vision. Integral photonic sensors. Panoramatic (image) photonic sensors. Integral photonic displays. Panoramatic photonic tonic elements. Basic elements of optical systems. Fundamentals of illumination. Fiber-optics elements and systems. Optical references to the control of t	ZK ZK cit displays. Electro	2 4 on optics. Image
will be derived from the part of the lecture will be XP16DEL XP37VKF Anatomy and physiological and the part of the	linearized MHD equations (magnetoacoustic waves - Alfven, F and S wave; electromagnetic waves in plasma - O, X, R, L wave devoted to final size waves, nonlinear phenomena (Landau damping) and solitons in plasma. History of technology and economic Selected Parts from Photonics by of vision. Integral photonic sensors. Panoramatic (image) photonic sensors. Integral photonic displays. Panoramatic photonic elements. Basic elements of optical systems. Fundamentals of illumination. Fiber-optics elements and systems. Optical ressors.	ZK ZK Ic displays. Electronethods of informatic	2 4 on optics. Image
will be derived from the part of the lecture will be XP16DEL XP37VKF Anatomy and physiolog converters. Special photoptical (photonic) processing the XP38VKP	linearized MHD equations (magnetoacoustic waves - Alfven, F and S wave; electromagnetic waves in plasma - O, X, R, L wave devoted to final size waves, nonlinear phenomena (Landau damping) and solitons in plasma. History of technology and economic Selected Parts from Photonics by of vision. Integral photonic sensors. Panoramatic (image) photonic sensors. Integral photonic displays. Panoramatic photonic tonic elements. Basic elements of optical systems. Fundamentals of illumination. Fiber-optics elements and systems. Optical references to the control of t	ZK ZK ic displays. Electronethods of information	2 4 on optics. Image ation processing.
will be derived from the part of the lecture will be XP16DEL XP37VKF Anatomy and physiolog converters. Special photoptical (photonic) process XP38VKP The course is dedicated.	Inearized MHD equations (magnetoacoustic waves - Alfven, F and S wave; electromagnetic waves in plasma - O, X, R, L wave devoted to final size waves, nonlinear phenomena (Landau damping) and solitons in plasma. History of technology and economic Selected Parts from Photonics by of vision. Integral photonic sensors. Panoramatic (image) photonic sensors. Integral photonic displays. Panoramatic photonic elements. Basic elements of optical systems. Fundamentals of illumination. Fiber-optics elements and systems. Optical ressors. Selected Parts of Instrumentation	ZK ZK ic displays. Electronethods of information ZK ZK ar sources of calibi	2 4 on optics. Image ation processing. 4 ration signals,
will be derived from the part of the lecture will be XP16DEL XP37VKF Anatomy and physiolog converters. Special photoptical (photonic) process XP38VKP The course is dedicated devices for measurements.	Inearized MHD equations (magnetoacoustic waves - Alfven, F and S wave; electromagnetic waves in plasma - O, X, R, L wave devoted to final size waves, nonlinear phenomena (Landau damping) and solitons in plasma. History of technology and economic Selected Parts from Photonics by of vision. Integral photonic sensors. Panoramatic (image) photonic sensors. Integral photonic displays. Panoramatic photonic elements. Basic elements of optical systems. Fundamentals of illumination. Fiber-optics elements and systems. Optical ressors. Selected Parts of Instrumentation d to principle, properties and applications of selected special measuring instruments. It deals mainly with calibrators and other	ZK ZK aic displays. Electronethods of information ZK ZK ar sources of calibrates are sources of calibrates are sources.	2 4 on optics. Image ation processing. 4 ration signals, al-time spectrum
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XP02VPA1	Selected Topics of Physics 1	ZK	4
XP02VPA2	Selected Topics of Physics B	ZK	4
XP02VPB	Selected Topics of Physics B	Z,ZK	4
XP02VPO	Selected Topics of Optics	Z,ZK	4
· ·	e equation, plane wave, polarization, reflection and refraction, natural and artificial anisotropy, optical modulators, coherence, inter-		
	ing, holography, methods of visualization, normal and anomalous dispersion, optical image formation, optical devices, photom	etry, colorimetry, a	atoms radiation,
stimulated emission, la XP33ROZ	·	ZK	4
	Selected Topics in Pattern Recognition Surse in pattern recognition (e.g. P33ROD, 33RPZ). Selected topics: Anderson's problem, Kozince algorithm, kernel perceptrol	1	
•	rz. Deterministic learning. Unsupervised learning: Robbins algorithm and emprirical Bayesian approach. Expectation-minimiza		
	ed acyclic graphs. Markov models. Combination of weak classifiers: boosting and bagging. AdaBoost.		
XP16MVE	Selected Problems of Economy and Management of Energy	ZK	4
The role of production	process in promoting the marketing concept of the firm and the competitive advantage. The system of operational planning w	ith respect to prod	uction typology.
Standardized basis of	production management, standardization. Controlling, production management methods.		
XP37SFA	Fundamentals of Physical Acoustics	ZK	4
=	sticity, Carthesian tensors. Theory of small deformations, dynamic equations of isotropic elastic medium. Microscopic model o	f fluids. Cinematic	s of fluids.
	fluids. Stationary flow of vascous fluid.		
XP16STM	Selected Statistical Methods	ZK	4
series.Index number.	ransformation of random variables. Aproximation of theoretical distributions. Interval estimates. Hypothesis testing. Simple and m	iuitiple regression.	Analysis of time
XP39VPG	Computational Geometry	ZK	4
	Computational Geometry ional geometry (CG), data structures and paradigms, methods of geometric search, convex polygons and hulls, applications o	1	=
	ngulation, efficient intersection algorithms, intersection of semispaces and polygonal regions, geometry of rectangles, dual ma		
-	s of computer graphics and CG. Students who completed course 36VGE cannot enroll.	11 3	-,
XP36VAP	Advaced Computer Architecture	ZK	4
Instruction level paralle	elism (pipelined, superpipelined and superscalar systems). Basic limitations to parallelism (structural, data and control hazard	s). Instruction fetcl	and execution
•	of order). Register data flow, software and hardware solutions, interlocking, scoreboard, control stack. Memory reuse, register re	•	•
	ormace evaluation, HPCC, supercomputers. Shared memory multiprocessors (bus, switch, switched memory). Interconnection		
•	rocessor systems. MIMD systems UMA, NUMA, COMA. Distributed memory multiprocessors (crossbar switch). Data flow syst	ems, multithreadir	ng. Accelerators,
special architectures.	Development and Describe of Materials	7 71/	
XP12VVM	Development and Research of Materials	Z,ZK	5
XP12VVM Research of composite	materials wth specific electrical properties. Diagnostics of materials in electrotechnology. Polymers. Phase transitions. Thin a	1 ' 1	-
XP12VVM Research of composite polymers. Organic sola	materials wth specific electrical properties. Diagnostics of materials in electrotechnology. Polymers. Phase transitions. Thin a recells. Models of function of biomaterials.	and thick conductive	e layers on
XP12VVM Research of composite polymers. Organic sola XP15VME	e materials with specific electrical properties. Diagnostics of materials in electrotechnology. Polymers. Phase transitions. Thin a cells. Models of function of biomaterials. Research Methods in th Use of Electrical Energy	z,ZK	re layers on
XP12VVM Research of composite polymers. Organic sola XP15VME Introduction into the m	materials wth specific electrical properties. Diagnostics of materials in electrotechnology. Polymers. Phase transitions. Thin a recells. Models of function of biomaterials.	Z,ZK erodynamics. Simil	e layers on 4 arity theory in
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List of courses of this pass:

Code	Name of the course	Completion	Credit
XEP17SWR	Scientific Writing	ZK	4
This course is intend	ded to help researchers organize and effectively communicate, in English, their scientific results. While the instructor is an Electrical applicable to all technical disciplines.	Engineer, the app	roaches ar
XEP33FLO	Fuzzy Logic Basics of fuzzy sets and fuzzy logic. Measures on collections of fuzzy sets. Principles of fuzzy control.	ZK	4
XEP33NEP	Neuroprosthetics	Z,ZK	4
	s concerned with the use of artificial devices to replace or improve the function of the human nervous system. The neuroprosthetic de		ı spread us
ystem and to direct only in Cochlea imple presenters own follow (i.e. a matheourse is compleme XEP33NUM The course introdund partial) different XEP33SAM In the course, the Flethods that have be the implementatic elf-contained mater	practical use. We will also see how such implants interact with the human nervous system, forming a bidirectional gateway both to me thy stimulate the human brain. As well as witnessing the exciting development of the field we will consider neuroprosthetics in terms of plants but also for visual and motor repair. We will however also look at the possibilities of Neuroprosthetics for general human enhancementation fits into teh field. Whilst the course will focus on technical issues, it will be presented in a general way such that the ematical background is not a requirement). Indeed as this technology has immediate impact, societal, ethical and moral issues raised entary to the lecture course given on Bionics: this set of lectures being specifically concerned with neural aspects - linking the human be technology. Numerical Analysis Indeed as this technology. Numerical Analysis Indeed Analysis	f practical restorate accement and investall students should will also be discubrain and nervous Z,ZK f transcendent and ration of their properties will focus entation, and to be ents will individually ussed methods to	tive use, no stigate how do be able assed. The system with the system and the system a
XEP33SML This advanced mad	Structured Model Learning chine learning course covers learning and parameter estimation for structured models like Markov Random Fields, Belief Networks a Networks.	ZK and (stochastic) De	4 eep Neura
XEP33VKR	Selected Topics in Pattern Recognition and Computer Vision	ZK	4
The course deals w	with fundamental results from computer vision and pattern recognition. The course treats selected key results, as well as latest areas rifluence the development in the subject field. Education is performed in the form of a reading group. The course is mainly targeting available for Msc students with strong interest, possibly experience too, on a research topic that is relevant to the course.	of research, espe	-
XEP35CMS	Computational Methods for Materials Science	Z,ZK	4
course, the stud thermodynamical p	course is to acquire advanced knowledge of Classical and Quantum Mechanics to design in-silico experiments within the Materials selents will know: - the fundaments of thermodynamics, newtonian and statistical mechanics, and how the relative formalism is implem properties; - how the Schrödinger equation is setup and solved in order to calculate physical quantities; - how to combine the classical results; and - a general protocol through which to design new materials at the atomic scale. By means of simulation laboratory experience learn how to setup and run simulations, and how to analyse and present the results by using post-processing softwares. Advanced Computational Game Theory	ented in order to c Il and quantum me	alculate echanics to
	•		4
XP01FA1	Functional Analysis 1 Measure theory and Lebesgue integral. An introduction to Hilbert spaces. Theory of linear operators in Hilbert spaces. Spectral t		•
istribution theory, F	Integral Transforms and Z Transform egral transforms, linearity. Laplace transform, inversion, limit theorems. Fourier transform. Application to solving integral and different ourier and Laplace transforms of distributions. Linear dynamic systems, causality, passivity, convolution. Systems with bounded spectro equations.	ım. Z-transform an	
XP01KAS ime and space con	Complexity and Combinatorical Algorithms nplexity of algorithms. P and NP problems and their solutions: exact solutions, heuristics, approximation schemes, probabilistic algorith	ZK nm. Equivalences o	4 of problem
	Quantum Computing grepresents a new programming paradigm. The safety of nowadays encypering techniques is based on enormous computation compl fety may be broken by quantum computers. The ``building stones" of a quantum computer and quantum computers will be develope design fast factorization algorithms, fast database search, etc.		
XP01MKR	Mathematics for cryptography Introduction to the theory of groups, finite fields, and polynomials over finite fields and their applications in cryptography.	ZK	4
XP01MTP	Mathematical Statistics g, ordered sampling and their distributions. Sample statistics. Point estimates and interval estimates. Confidence intervals. Estimation stimates. Hypothesis testing for distribution parameters. Hypothesis testing for equality of parameters. Nonparametric tests. Regressi Matrix Calculus rdan blocks, Jordan canonical matrices. Real canonical form of a real matrix. Characteristic and minimal polynomial. Caley-Hamilton the Symetric, orthogonal and positive matrices. Diagonalization of symetric, positive and circulant matrices. Singular value decomposition. I matrix. Generalized solution of systems of linear equations.	on analysis. ZK oerem. Functions	4 of matrice
	matrix. Scholarized Solution of Systems of illiear equations.		
XP01MTS	Mathematical Methods in Signal Theory	ZK	4

VDOANUA			
XP01NLA	Numerical Linear Algebra	ZK	4
Background matri	x algebra. Norms of vectors and matrices. Numerical linear algebra. Special systems. Eigenvalues and eigenvectors. Iterative method	ds. Matrix inversion	. Singular
	value decomposition. Generalized solutions of linear systems.		
XP01PDR	Partial Differential Equations	ZK	4
XP01SPJ	differential equations of mathematical physics. Initial and boundary value problems. The method of characteristic functions, integral Syntax and semantics of a formal language	ZK	4
	ics of a formal language.A simple imperative language, assignment command. Denotational and operational semantics, coherence t		
-	is of functionals, recursive definitions. Lambda - notation. A simple functionI language, denotational semantics. New functions definiti		
Operation	onal semantics. Other approaches to semantics, continuation semantics. Axiomatic (Hoare's) semantics. Expressive power of a progr	amming language.	
XP01TEM	Selected chapters of the measure theory	ZK	4
Basic properties	of finetely additive and sigma-additive measures, classic results (the Radon-Nikodym theorem and the Carathéodory theorem), the experimental of the control	-	additive
\/D04 T 0D	measures (the Horn-Tarski technique, the Banach limit method, some questions of the lifting, etc.), the Hammer-Sobczyk theo		
XP01TGR	Graph Theory aph theory. Trees, their characterization, minimal spanning tree. Strongly connected components, rooted trees. Shortest paths, Floyds	ZK	4
_	Hamiltonian graphs and their applications. Chvatal's theorem. Flow in networsk, admissible flows and admissible circulations. Matchi	-	
	ertex cover and independent sets. Cliques. Colorings. Plannar graphs. Graphs and vector spaces. The content of the course is modifi		
-	students.		
XP01TJA	Languages, Automata and Grammars	ZK	4
Finite automata. Ne	rod theorem and its applications. Nondeterministic automata. Regular expressions nad Kleene theorem. Grammars and their classific		grammars.
VDOALIAO	Chomsky hierarchy. CYK algorithm for context-free grammars. Turing machines, decision problem. Algorithmically nonsolvable pro		
XP01UAG	Introduction to Algebraic Geometry	ZK	4
	he solution sets of systems of polynomial equations in more than one variable and their relationship with the ideals in polynomial ring ebner's bases and their properties, Buchberger's algorithm for searching a Groebner's basis, elimination theory, Hilbert's Nullstellens		
240.0 ti.00.0, 3 .0	varieties and radicals.	auz, comcoponacin	201110011
XP01UNA	An introduction to nonassociative algebras	ZK	4
The basic course	in the theory of nonassociative algebra. We introduce the otions of free nonassociative algebra, tensor algebra, bimodules and irepresentations of the control of the contr	esentations for alge	bras in a
	va big attention on the ariety of alternative algebras and composition algebras. We define Lie, alcev and Jordan algebras, their unive	rsal enveloping alg	
XP01USA	An introduction to superalgebras.	ZK	4
The basic course in	the theory of superalgebras. We introduce notions of a graded algebra, superalgebra, Grassmann envelope of a superalgebra. Cons	ider varieties of sup	eralgebras
XP01VPS	and identities in superalgebras. We pay a big attention on the variety of alternative and Jordan superalgebras.	ZK	4
AFUIVES	Selected topics in probability and mathematical statistics Students will learn the terms of probability and procedures of mathematical statistics that go beyond commonly taught metho		4
XP01ZWT	Wavetet Transform.	ZK	4
-	ontinuous wavelet transform. Time and frequency localization. Discrete wavelet transform. Riesz bases and frames. Multiresolution ar		
•	processing.		-
XP02AMA	Active Methods in Acoustics	ZK	4
	, interference, Huygens principle, sound field in ducts, vawe-guides and enclosures. Active noise control in a duct. One or more seco	•	
in enclosures, acou	stic coupling, modes, local control. Feedback and feedforward strategy, analog adn digital realisations, algorithms based on LMS, stabi	lity of algorithms, m	ultichannel
XP02DP	algorithms. Practical realisations of active systems. Active control of vibrations, transducers for active control. Electric Discharges and their Applications		
-		7K	1
Classification of e	lectric discharges. Townsend?s theory. Glow discharge. Processes on the surface of electrodes. Technological applications. Plasma of	ZK displays. High-frequ	4 ency and
	lectric discharges. Townsend?s theory. Glow discharge. Processes on the surface of electrodes. Technological applications. Plasma c arge. Arc. Corona. Spark discharge. Lightning. Ball lightning. Z-pinch and its properties. Electromagnetic collapse. X-ray sources, con	displays. High-frequ	ency and
	lectric discharges. Townsend?s theory. Glow discharge. Processes on the surface of electrodes. Technological applications. Plasma of arge. Arc. Corona. Spark discharge. Lightning. Ball lightning. Z-pinch and its properties. Electromagnetic collapse. X-ray sources, con magnetic fields of Earth.	displays. High-frequ	ency and
microwave discha	arge. Arc. Corona. Spark discharge. Lightning. Ball lightning. Z-pinch and its properties. Electromagnetic collapse. X-ray sources, con magnetic fields of Earth. Physics for Electroenergetics	displays. High-frequent trolled fusion. Gene	ency and eration of
microwave discharge XP02EVA Lessons contain se	arge. Arc. Corona. Spark discharge. Lightning. Ball lightning. Z-pinch and its properties. Electromagnetic collapse. X-ray sources, con magnetic fields of Earth. Physics for Electroenergetics ected parts of physics for students of electric power engineering: Physical principles of gas discharges - glow, arc, spark and corona dis	displays. High-frequent trolled fusion. Geneed ZK charges and their a	ency and eration of 4 pplications.
microwave discharge XP02EVA Lessons contain se	arge. Arc. Corona. Spark discharge. Lightning. Ball lightning. Z-pinch and its properties. Electromagnetic collapse. X-ray sources, con magnetic fields of Earth. Physics for Electroenergetics ected parts of physics for students of electric power engineering: Physical principles of gas discharges - glow, arc, spark and corona dis ne acquainted with characteristics for magnetized, astrophysical and fusion energy generation. A part of the course is two excursions i	displays. High-frequent trolled fusion. Geneed ZK charges and their a	ency and eration of 4 pplications.
microwave dischi XP02EVA Lessons contain sel The students becor	arge. Arc. Corona. Spark discharge. Lightning. Ball lightning. Z-pinch and its properties. Electromagnetic collapse. X-ray sources, con magnetic fields of Earth. Physics for Electroenergetics ected parts of physics for students of electric power engineering: Physical principles of gas discharges - glow, arc, spark and corona dis ne acquainted with characteristics for magnetized, astrophysical and fusion energy generation. A part of the course is two excursions i Academy of Sciences.	displays. High-frequent trolled fusion. General ZK charges and their an laboratories CTU	ency and eration of 4 pplications. and Czech
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XP02EVA Lessons contain sel The students becor XP02FPL XP02HS Sound field, noise XP02MHD XP02PT XP02SF XP02TF1	arge. Arc. Corona. Spark discharge. Lightning. Ball lightning. Z-pinch and its properties. Electromagnetic collapse. X-ray sources, con magnetic fields of Earth. Physics for Electroenergetics ected parts of physics for students of electric power engineering: Physical principles of gas discharges - glow, arc, spark and corona discharge acquainted with characteristics for magnetized, astrophysical and fusion energy generation. A part of the course is two excursions in Academy of Sciences. Solid State Physics The course provides fundamentals of solid state physics at large. Noise Surveys and vibration measurement, noise legislation, hygiene control. Types of noise surveys, examples, types of noise sources. Noise magnetic in working environment. Noise in buildings. Transport noise, airport noise. Technical principles of noise control. Magnetohydrodynamics Qualitative description of the behaviour of hot plasma in magnetic fields Plasma Technologies Statistical Physics The lecture is devoted to the fundamentals of statistical physics. It is the third part of four-part lecture cycle. Theoretical Physics 1	zK charges and their a n laboratories CTU ZK charges and their a n laboratories CTU ZK charges, principles and charges and c	4 pplications. and Czech 4 d types of 4 4
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XP02EVA Lessons contain sel The students becor XP02FPL XP02FPL XP02HS Sound field, noise XP02MHD XP02PT XP02SF XP02TF1 The lecture Theore XP02TF2 XP02TZP The aim of this cour from the prime lave	arge. Arc. Corona. Spark discharge. Lightning. Ball lightning. Z-pinch and its properties. Electromagnetic collapse. X-ray sources, con magnetic fields of Earth. Physics for Electroenergetics ected parts of physics for students of electric power engineering: Physical principles of gas discharges - glow, arc, spark and corona dis ne acquainted with characteristics for magnetized, astrophysical and fusion energy generation. A part of the course is two excursions in Academy of Sciences. Solid State Physics The course provides fundamentals of solid state physics at large. Noise Surveys and vibration measurement, noise legislation, hygiene control. Types of noise surveys, examples, types of noise sources. Noise magnetics. Noise in working environment. Noise in buildings. Transport noise, airport noise. Technical principles of noise control. Magnetohydrodynamics Qualitative description of the behaviour of hot plasma in magnetic fields Plasma Technologies Statistical Physics The lecture is devoted to the fundamentals of statistical physics. It is the third part of four-part lecture cycle. Theoretical Physics 1 tical Physics 1 is a basis for the following lectures of theoretical physics for the doctoral study. The main aim is theoretical Mechanics motion in curvilinear coordinates. Theoretical Physics 2 The lecture is devoted to the fundamentals of physics in Dirac formalism. It is the second part of four-part lecture cycle of Sound Field se is deeper understanding the fundamentals of physical acoustics. The continuity equation, Euler and Navier-Stokes equations and the se of fluid dynamics. These equations are utilized for derivation of a linear wave equation under the acoustical approximation; its specific parts and sucretical parts and sucretical approximation; its specific parts and sucretical parts and sucretica	zK charges and their a n laboratories CTU ZK charges and their a n laboratories CTU ZK coping, principles and ol. ZK ZK z,ZK z,ZK z,ZK z,ZK cle. ZK ae energy equation cial solutions are di	ency and eration of 4 pplications. and Czech 4 d types of 4 4 scription of 4 are derived scussed.
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in various areas o	of human activity. It also lists safety principles for working with lasers. In the practical part, it is supplemented by visits to top workplac dealing with the given issue.	es (e.g. PALS, ELI	I, HiLASE)
XP02UZ	Ultrasound and Quantum Acoustics	ZK	4
	se lectures is to familiarize doctoral students with the issues of ultrasonic waves needed for the design of a wide range of ultrasonic despends that the destard student could use in his work. The subject of the effection reason of classic and recently developed findings for		cuss in detail
XP02VNP	e parts that the doctoral student could use in his work. The subject of the offer is a range of classic and recently developed findings fr Plasma Waves and Instabilities	Z,ZK	4
	mena will be introduced in the first part of the lecture (dispersion relation, phase and group velocities, Fourier analysis). Fundamenta		
	m the linearized MHD equations (magnetoacoustic waves - Alfven, F and S wave; electromagnetic waves in plasma - O, X, R, L wave		
	part of the lecture will be devoted to final size waves, nonlinear phenomena (Landau damping) and solitons in plasma.		
XP02VPA1	Selected Topics of Physics 1	ZK	4
XP02VPA2	Selected Topics of Physics B	ZK	4
XP02VPB	Selected Topics of Physics B	Z,ZK	4
XP02VPO	Selected Topics of Optics	Z,ZK	4
	vave equation, plane wave, polarization, reflection and refraction, natural and artificial anisotropy, optical modulators, coherence, interfere		
diffraction, optical g	grating, holography, methods of visualization, normal and anomalous dispersion, optical image formation, optical devices, photometry stimulated emission, lasers.	, colorimetry, atom	ns radiation,
XP02ZFP	Fundamentals of the Plasma Physics	ZK	4
	rovide you with a basic knowledge of plasma physics and of its applications. Plasma definition. Main plasma characteristics. Collision		1
	model Magneto-hydrodynamics. Aplications.		
XP04A1	English language 1	NIC	
The course revises	general English from previous studies, further develops speaking skills, listening and recalling spoken English as well as note-taking	skills. Provides ba	sic scientific
\/D0444714	terminology (cause-effect relationship, definitions, classification, basic information on composing written documents).	717	1 0
XP04A1ZK	English language 1	ZK	0
The subject AT ZK	is only for those postgraduate students studying in older study program valid up to Sept.2003 and did not ask for studying languages program.	according to the	newer study
XP04A2	English language 2	NIC	
	ing written documents (papers, reports, articles, dissertations, official letters); oral presentations, reading skills (getting both general	_	nation); the
	ing speech in a foreign language; selected parts of difficult grammar; selected items focused on practical skills (reading mathematical		-
	writing CV). Oral presentations.		
XP04A2SZK	English Language	ZK	0
XP04A2ZK	English language 2	ZK	0
	ect is only for those postgraduate students who study in older program valid up to Sept.2003 and did not ask for studying the new lan		
XP04AZK	English Language	ZK	0
VD0404714	http://www.fel.cvut.cz/anketa/aktualni/courses/XP04AZK		
		71/	
XP04C1ZK	Czech language 1	ZK	0
XP04C2ZK	Czech language 2	ZK	0
XP04C2ZK XP04F1	Czech language 2 French language 1	ZK NIC	0
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XP04R2ZK	Russian language 2	ZK	0
XP04S1		NIC	0
	Spanish language 1 lowledge of Spanish language, including the language for specific purposes.Specific technical style characteristics focused on specific		_
norodonig donvo id	comprehension, oral presentations, understanding the text-all based on intermediate level language.	o grammar and lo	KIO. LIOTOTIIT (
XP04S1ZK	Spanish language 1	ZK	0
XP04S2	Spanish language 2	NIC	0
	lls(listening,understanding a Spanish text of cca 120 pages, writing, speaking). The skills are practiced on writing letters, presentation		d oral,news
etc. Indi	ridual home preparation is necessary. Materials are chosen with regards to the study field of a postgraduate. High-level and fluent spe	eech is demanded	d.
XP04S2ZK	Spanish language 2	ZK	0
XP04 1	Czech language 1	NIC	0
XP04 2	Czech language 2	NIC	0
XP12IMM	Engineering Methods in Mechanics	Z,ZK	4
Review methods so	lution of problems in rigid bodies mechanics, hydromechanical, thermodynamic and electromechanical systems. Dynamics of combine	d systems with us	ing method
	nalytical mechanics, assembling of mathematical model and resources for simulation. Identification of system parameters with respec	-	ances and
	nergy losses. Physical similarity and analogy, dimensional analysis, dimensionless parameters, PI-terms, fundamentals of experiment		_
XP12VVM	Development and Research of Materials	Z,ZK	5
Research of com	posite materials wth specific electrical properties. Diagnostics of materials in electrotechnology. Polymers. Phase transitions. Thin and polymers. Organic solar cells. Models of function of biomaterials.	a thick conductive	layers on
XP13DFD	Data and Functional Analysis of Production Systems	Z.ZK	4
	m of production enterprise and its structure. Relationship of technological system to other systems. Tools of control and information of er	_,	1
	lysis of enterprise. Date base of technical preparation of production. Methodology of functional analysis of enterprise. Methods of dat	•	-
	is of user interface of enterprise IS. Object oriented methodology of analysis of enterprise. Methods of time analysis of enterprise. Us		-
,	enterprise. Documentation and standards for data and functional analysis. Automation of analysis methods, CASE tools.		,
XP13FCD	Photovoltaics systems	Z,ZK	4
	ses the most important problems of principle, technology of production and final use of photovoltaic systems for power generation. To		y and basic
principles of con	version. Photovoltaic effect, photovoltaic cells. Optimization of cell structure in terms of optical and electrical properties of individual la	ayers. V-A characte	eristics of
	etermination of the maximum theoretically achievable energy conversion efficiency of a given structure. Photovoltaic modules. Technology	-	-
	otovoltaic cells and modules. Characterization and diagnostic methods, analysis of failure types, influence on durability. Photovoltaic syst		
	onents of photovoltaic systems. Simulation of yield for a given type of climate and season. Trends in applications of photovoltaic systems.		
XP13FDD	Physic of Dielectrics	Z,ZK	4
	anizmus of polarization. Dielectric absorption. Electrical conductivity of insulators. Dielectrics in static electrical field. Dielectrics in time		
Frequency disper	sion of polymers. Thermal dispersion of polymers. Optical properties of dielectrics. Dielectrics losses. Electrical strength of insulators.	Electrical propert	ties of thin
VD42EDD	dielectrics films. Ageing of insulators. Properties of feroelectrics. Main and joined phenomena in dielectrics.	7 71/	1
XP13FPD	Semiconductor Physics urse is to deepen the knowledge of the properties of semiconductor materials and structures that are important for a deeper understa	Z,ZK	4
The aim of the co	components technology.	anding of the sem	iconductor
XP13MSD	Modelling and Simulation of Technological Systems	Z,ZK	4
	mputer modelling and simulation. Programs processing port diagrams or block diagrams. Text edited systems and examples. Graphic		nd examples
- SIMULINK. Model	ling of electric and electronic systems. Models of power semiconductor devices, modelling of power semiconductor systems. Example	es of simulations.	Modelling o
	mechanical and electromechanical systems, hydraulic systems and thermal systems. Examples of simulations.		
XP13PED	Plastics in Electrical Engineering	Z,ZK	4
	in electrical manufacturing. Exercise plastics in the production of the cables, structural members etc. The specialty requirements on the p	-	
_	dity, of shape constancy). Composite materials from out plastics. Technology treatment of plastics. Degradation of plastics impact of e		tic and the
	hanic stability and chemical resistance). The plastic waste. Recycling of plastics. Impact of production and the used up plastics on the		
XP13PSD	Flexible Production Systems	Z,ZK	4
, ,	s of automation. Flexible automation. Basic components of FMS. Machining centres, flexible manufacturing cells and islands. Option, ε d its components. Interfaces. Systems of automatical self checking of quality. CNC machines appropriate for FMS. Manipulators and ι		
	nd its control. CNC for the control of FMS. Flexible assembling systems. Automated plants of future, conception and tasks. Efficiency		-
XP13SID	Software in Industrial Engineering	Z,ZK	4
	g of IBM compatible personal computers, their architecture. Using of application programs for mathematics, graphics, text processing,		I
The Gadonon to dom.	of software systems. Introduction to user interface based on Microsoft Windows.		2, oxap.o.
XP13SJD	Quality Control Systems	Z,ZK	4
	lity and reliability. Basic quality management systems. ISO 9000, TQM, Kaizen. Basic characteristics of ISO 9000. Quality manual. Qu	,	1
and their role in au	ality. Mathematical model based on factor experiments. Optimization of mathematical model. Six Sigma quality management system a	and its implement	ation. Basic
and their role in qu	Sigma system. Reliability as a subset of quality. Mathematical distributions used in the field of reliability. Usage and maintenance coeff	ficient. Backup - ty	pes and
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tools of the Six S	mathematical description. Accelerated reliability testing. Processing and analysis of experimental data.		
tools of the Six S	mathematical description. Accelerated reliability testing. Processing and analysis of experimental data. Real Time Systems for Process Control	Z,ZK	4
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XP13SRD Introduction to using	mathematical description. Accelerated reliability testing. Processing and analysis of experimental data. Real Time Systems for Process Control g of real time control paradigm. Architecture of real time systems. State transition diagram of real time systems. Semaphore and deadlo in control of technological systems.	ck. Using of real ti	me systems
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XP13SRD Introduction to using XP13SSD The evaluation of the	mathematical description. Accelerated reliability testing. Processing and analysis of experimental data. Real Time Systems for Process Control g of real time control paradigm. Architecture of real time systems. State transition diagram of real time systems. Semaphore and deadlo in control of technological systems. Special Methods of Devices Quality Evaluation e principal values determining the quality of the passive and active devices. Measuring methods, their evaluation, identification of systems, who ports parameters of the device. Matching of the device to the measuring circuit. The noise of the electronic circuits, optimal in Non-linearity of the "linear" circuits, intermodulation distortion, measuring of the non-linearity and intermodulations.	ck. Using of real ti Z,ZK tematic faults. The noise and power n	4 description natching.
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phenomena. Prope	rties and technology of metallic and high temperature superconductors. Thermal insulation of low temperature equipments. Low temperature and work in low temperature laboratory. The use of low temperature technology in practice.	ture thermometry.	Accessories
XP13TPD	Technological Processes in Electronic Manufacturing	Z,ZK	4
Development of tec	chnology of packaging. Contemporary methods of packaging of components SOP, DIP, SIP, ZIP, QFP and others, properties, advantage	es,disadvantages.	Comparison
	the viewpoint of environmental resistivity. Classification of multichip modules. Multichip modules of different types: MCM-L, MCM-C, N		
multichip modules	s. Technology of contacting og dies. Electrical design of MCMs. Thermal design of MCMs. Physical design of MCMs. Parameters for e of MCMs. Design tools. Programmable modules. Applications of MCMs.	valuation of MCMs	s. Reliability
XP13VTK	Vacuum technology and cryogenics	Z,ZK	4
	uminous processes. Surface processes. Processes circulative to wall. Vacuum pumps. Measurements in vacuum techniques. Principle		
	ts for achievement of low temperatures. Properties and behavior of matters at low temperatures. Transport of heat and insulating syst		
XP14APR	rmometry.Laboratory training and seminars are focused to obtain a basic practical proficiencies and the other knowledges in vacuum		1
XP14APK XP14DES	New Trends in Electric Device Apply	ZK ZK	3
	Dynamics of Electric Machines play an important role in a number of areas, such as e-mobility, renewable energy sources utilization, robotics and automation. The r		1 .
	dents with deep understanding of the principles, operation, and analysis of rotating electric machinery. Mathematical models based or	•	
-	eloped for various types of electric machines (induction machines, electrically excited synchronous machines, permanent magnet sync		-
understanding of	f electrical machine theory on such a level is necessary, for instance, for design of modern control methods of electric drives or const	ruction of electric i	machines.
XP14EMC	Electromagnetic Compatibility	ZK	4
Interference sour	rces. Interference coupling. Shielding. Earthing. Nonlinear consumers. Harmonics in electric convertors in steady and transient condit	ions. Supression o	of negative
	converor influences on the network. Compensation and filtration.		
XP14MEN	New Trends in Converter Technology	ZK	4
	udy is to introduce students to the principles and functions of latest topologies of power semiconductor electric energy converters, tak	_	-
	ontent of the subject is the optimization of the power conversion parameters in power semiconductor converter systems. The subject is rinciples, topologies, functions and possibilities of application of power semiconductor converters realized on the basis of modern pow	•	
•	powerful control microcomputers. The topics are focused on pulse width modulation methods for voltage and current control, modes		
	r, active control of the current curve and the voltage curve, as well as the overall quality of electric energy transmission. The problems	=	
	matrix converters, multi-level converters, resonant converters as well as problems related to their practical use are also solve	ed.	
XP14MIR	Microprocessor Control of Electric Drives	ZK	3
· · · · · · · · · · · · · · · · · · ·	r, digital signal processor (DSP), digital signal microcontroller (DSC), architecture, computational resources, fixed point, fraction, float		-
•	roller, special blocks, ADC, event memory, FIFO, CAM, Multiport RAM, impulse signal generation, serial communication, methods, bus		
multiprocessor sy	stems, parallel processing, RT systems, solution methods, systems: INT, BG-FG, FSA, CC, preemptive RTOS, tasks, queues, semal computer programming methods, control computer resources application in scalar and vector control of electric drives.	onors, critical secti	ion, control
XP14MRP	Advanced Controlled Drives	ZK	3
XP14MZR	New Control Methods for Electric Drives	ZK	4
	rese is to introduce students to the latest issues of control and regulation of electric drives, taking into account the focus of their doctoral		
			-
electromechanical	energy conversion parameters in electric drive systems and relevant power electronics, in particular by using modern control and reg	ulation algorithms	. The course
electromechanical	energy conversion parameters in electric drive systems and relevant power electronics, in particular by using modern control and reg is mainly focused on electric AC drives, especially drives with asynchronous and synchronous motors.	ulation algorithms	. The course
XP14TPR		ZK	3
	is mainly focused on electric AC drives, especially drives with asynchronous and synchronous motors.	-	1
XP14TPR XP15DVN Failure rate of oper	is mainly focused on electric AC drives, especially drives with asynchronous and synchronous motors. New Trends in Electric Device Theory Diagnostics of HV and EHV Insulating Systems ation, fault sources and mechanisms. Indoor and outdoor insulation of electrical equipment. Diagnostic methods, using in operation. Ch	ZK Z,ZK noice of methods for	3 4 or diagnostic
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interferences in power networks, prediction and limitation of disturbances due to non-linear loads. Static stability of the power system and its criteria. Dynamic stability of the power system and its criteria. Methods for increasing of the stability in power systems. Multimachine transient stability. Reliability of the power transmission systems. Z,ZKXP15RE Control of Power Systems 4 Objective functions of power system control, feasibility and algorithms of optimization methods, handling of constrain conditions. Hierarchy and decomposition of system controlling tasks. System state estimation. Load forecasting and load curve civering. Unit commitment. Optimization of operation with respect to net topology constrains. Control of voltage and reactive powers balance. Control of frequency and active powers balance. Optimal power flow. Dynamical models of power stations and systems. Solution of extraordinary states... Dispatch, system and subsidiary services. XP15SPS Coupled Problems in Heavy Current and Power Engineering Concept of a coupled problem, classification of the coupled problems typical for heavy cur-rent and power applications. Mathematical description of the relevant physical fields, links between corresponding partial differential equations. Characteristics of electromagnetic-thermal problems (with respecting eventual thermoelasticity), electromagnetic-thermal-hydrodynamic and electromagnetic-mechanical problems and also problems based on a com-bination of the electromagnetic field and electric circuits. Formulation of their mathematical and computer models and algorithms of their solution. Information about available SW, its existing capabilities and perspectives. XP15TOS Theory of Light field 7.7K Theory of light field. Mathematical description of emission of unsymmetrical luminaires. Photometry of distante and close point. New characteristics of space properties of illumination. Flux method calculation of integral characteristics. Light field of surface type and cube type luminaire. Light flux distribution from point source. Distribution of light flux of linear source. Distribution of light flux of surface source. Interreflection theory. Design of indoor illumination using PC. XP15UEE Electric Energy Use and Conservation Z,ZK 4 Research Methods in th Use of Electrical Energy XP15VME Z,ZK Introduction into the mathematics of continuum physics. Physical conservation laws. The laws of electromagnetic field. Similarity theory in thermo-aerodynamics. Similarity theory in electromagnetic field. Mathematical modeling. Analytical solutions of electromagnetic field. Discrete parameters and their relation with field parameters. Numerical access to deterministic mathematical modeling of fields. Non-deterministic modeling. Experiment and data processing, practical examples. XP15ZSS Light sources and Equipment Z.ZK 4 XP16DEL 2 History of technology and economic ZK XP16EKO **Economics** ZK 4 Basic economic terms. Principles of microeconomics, consumer behaviour and producer behaviour. Profit maximization. Perfectly competitive market. Market failure, monopoly. Principles of macroeconomics, aggregate demand and aggregate supply. Labour market. Money market and capital market. Macroeconomic policy of the government as a factor protecting and correcting the market. Comment: The subject is a necessary precondition for understanding other economic and managerial disciplines XP16EME **Economics and Management of Energetics** Organizational structure of electric power sector, heating and gas sector. Principles of integrated source planning. Revenues, costs, prices and tariffs of energy. Governmental energy policy. Development of international cooperation in power industry and its economic and ecology aspects. Accounting ZK Principles of accounting. International accounting standards (IFRS). Methodology of accounting. Cost, revenues, profit and cash flow. Balance sheet, profit and loss account. Analysis of company's financial position. XP16FIM Financial Management ZK 4 Principles of finance, present value and alternative cost of capital, net present value, present value of bonds and stocks, investment decision making and net present value, return and alternative cost of capital, risk and return, lease or buy decision, inflation and return, real options, financial options, option valuation, hedging, short term finance, cash flow finance. XP16FVT Philosophical Problems of Science and Technology The course is engaged in the evolution of principal ideas on which the science and technology are founded. Philosophical aspects of physics and mathematics are deeper examined. Actual themes linked to the so called "Postmodernism" and to the alternative ways of understanding and their social coherences are discussed. XP16JAK 4 **Quality Management** Quality assurance in the organization. Statistical methods in quality management. Models of quality systems. Economic issues in quality assurance. Implementation of requirements of ISO 9001 standard. Certification of products and production systems. Recommendations for quality management in the organization. XP16KVM Quantitative Research Methods in Management 7K 4 Application of software SPSS for advanced statistical methods as multiple regression and correlation, analysis of variance, factor analysis, cluster analysis and its using in marketing research and management. XP16MAN Management ZK Principles of management and its innovation, modern ways of management, responsibility of managers, manager's ethics, successful manager thinking and behaviour XP16MAR Marketing 4 The role and functions of the marketing management. Marketing research and marketing information system. Concepts of marketing strategy. The use of product life cycle and portfolio. Product and service policy, pricing and contractation policy, communication, distribution. Marketing mix. XP16MAS Marketing Strategies ZK 4 Broadening of basic knowledge of marketing. The analysis of marketing strategies in different market situations. The firm's behavior under competition and competitive advantage Case studies in the field of product policy, price and condition policy, communication policy and distribution policy. XP16MAU Accounting for management 7K 4 The principles of managerial accounting. Relations to the organisational structure of the enterprise and to the production process. Budgets, use for management. Calculations and cost analyses. Productivity and measurement of productivity in the production process. The managerial information systems XP16MAV **Production Management** ZK The role of production process in promoting the marketing concept of the firm and the competitive advantage. The system of operational planning with respect to production typology Standardized basis of production management, standardization. Controlling, production management methods. XP16MES Economics and Management of Energy Systems ZK Strategic questions of electric power sector, gas systems and central heating systems functions. Marginal revenue in electric power system. Marginal costs of electricity, heat and gas. Power elements optimization, subsystem and system optimization in generation and transportation of different kinds of energy. Reliability in energy delivery. International cooperation in power industry. Energy price regulation and its consequences XP16MEU **Economics and Management of Energetics** 4 7K Organizational structure of electric power sector, heating and gas sector. Principles of integrated source planning. Revenues, costs, prices and tariffs of energy. Governmental energy policy. Development of international cooperation in power industry and its economic and ecology aspects. XP16MVE Selected Problems of Economy and Management of Energy The role of production process in promoting the marketing concept of the firm and the competitive advantage. The system of operational planning with respect to production typology. Standardized basis of production management, standardization. Controlling, production management methods.

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XP16STM	Selected Statistical Methods s. Transformation of random variables. Aproximation of theoretical distributions. Interval estimates. Hypothesis testing. Simple and multip	ZK	4 lysis of time
Descriptive statistic	series.Index number.	ne regression. 7 tha	ly 313 OF till 10
XP16STV	Product Strategy	ZK	4
	vice policy, pricing and contractation policy, communication, distribution. Marketing mix. Inovations. Concepts of marketing strategy. F		=
	management. The strategic marketing simulation Markstrat.	_	
XP17ANS	Selected Chapters from Antennas and Propagation	ZK	4
	nas and modern antenna technology. Selected problems of antennas and propagation for fixed and mobile communication, earth and		
management for	different services and communication. Topics of near a far field antenna measurement, compact antenna measurement. Measurement	nt of signal level fo	r specific
	services. Antenna anechoic chambers design.		
XP17APL	Applied Optoelectronics in Medicine	ZK	. 4
•	of non-invasive measurement techniques in medical diagnostics. Fundamental physiology of the vascular system, hemodynamics, son of the cardiovascular system. UV, VIS and IR spectroscopy. Fundamental optics of the eye and color analysis. Optical parameters		
Computer simulation	of light, Design of optical sensors, Optical visualisation principles of translumiscetion and tomography, Optoelectronic systems in n	-	Dispersion
XP17ELD	Electrodynamics	ZK	4
XP17LAE	Medical Applications of Electromagnetic Field	ZK	4
	es of EM Field medical applications. Principals and technical equipment for EM thermotherapy, hyperthermia applicators. Calculation		
	ails of microwave thermotherapy apparatus are given, especially from the point of view of applicators for local, intracavitary and region		
	thermometry (NMR, ultrasound and radiometry) and special compatible applicators are described.		
XP17MAPP	Analysis Methods for Passive Elements of Microwave and Millimeter-wave Technique	ZK	4
Computation of tran	nsmission lines parameters. Computation of microwave circuits scattering parameters, analysis of planar antennas. Survey of basic m	ethods for analysis	s of passive
circuits with the	stress on methods: spectral domain, integration equation, finite differences, finite elements, mode matching, transversal resonance. S	Survey of basic the	orems of
	electromagnetic fields, moment method, disturbance method.		
XP17MT	Microwave Technique	ZK	4
	ission lines and its circuit elements including hybrid and monolithic integrated circuits technology. Resonators and other type of pass		
attenuators, coup	elers, isolators and circulators, modulators etc.) and active microwave circuits (e.g. oscillators, mixers and amplifiers), microwave filter CAD of microwave circuits.	s, microwave meas	surement.
XP17MVP		ZK	
	Methodology of Science	ZK	4
XP17NME	Numerical Methods in Electromagnetic Field noholtz and wave equations. Analytical, semianalytical, seminumerical and numerical methods. Matrix equations and algorithms: Moc		4 gua Paint
	Method of Moments, Multiple MultiPoles, Boundary Element Method, Finite Difference Method, Finite Element Method, Finite Integration	-	-
-	of matrix equations: direct methods, Gauss-JordanOs elimination, pivotation, LU-decomposition, banded and sparse matrix, conjuga	=	
XP17OV	Optical Fibers	ZK	4
_	otical fibers, attenuation and dispersion, step-index fibers, gradient fibers, single and f1ibers, optical cables, splices and connectors, o		
	fabrication, nonlinear phenomena in optical, fibers, fibers for sensors.		
XP17TAM	Evaluation of Applicators for Microwave Thermotherapy	ZK	4
Lectures are focus	sed on methodology of evaluation of microwave applicators, which means measurements of SAR distribution in water phantom and r	neasurements of te	emperature
	ous types of agar phantoms. Further design and optimisation of measuring probes is discussed, methodology of probes calibration a		evaluation
	escribed. Numerical modelling of microwave applicators by aid of software product FEMLAB, comparison of mathematical and exper		
XP17TVC	Technique of Highly Sensitive Receivers	ZK	, 4
	r sensitive microwave receivers, mm - wave and submm - wave receivers. Electromagnetic spectrum and noise properties of the Eart tre wave communication. Semiconductors for microwave and millimetre wave bands, SIS detectors, mixers, infrared receivers. High freq	· · · · · · · · · · · · · · · · · · ·	
	surement of noise parameters. Multispectral radiometry and remote sensing, electromagnetic radiation - interference, EMC theory and	•	teci ii lology,
XP31AEO	Electric Circuit Analysis	ZK	4
	devices and structures. Methods of analysis and algorithms for linearized circuit models in time domain and frequency domain. Trans		
	nalysis of nonlinear circuits in time and frequency domains. Parametric models. Circuits with non-linear energy storing elements. Circ	•	
	professional software packages.		
XP31ART	Architectures for Real Time Implementation	ZK	4
	ntral processing units and synthesis of data paths for DSP. Implementation strategies of DSP algorithms. Influence of algorithm modified	-	
	equential and parallel processing. Numerical characteristics of algorithms. Implementation alternatives, dedicated hardware and proc		
Architectures of dig	ital signal processors with fixed point and floating points. Developments tools for real time processing. Analysis of real time implemen	tation of FFI, digita	al filters and
VD04 A CNI	special algorithms for communications.	71/	4
XP31ASN	Algorithms and Structures of Neurocomputers the basic principles and possibility of the application of the neural informative technology for the signal processing are the main topic	ZK	4
	o the artificial neural networks (ANN) theory and applications, to the choice and the optimisation of the structures and the neural networks.		
	ssing are investigated in detail. Some neural network applications in the biomedical engineering and hardware realization of the KSO	• • •	t tile signal
XP31DIF	Digital filter synthesis	ZK	4
	gital signals. Impulse response, step response, convolution. Elements of z-transform and Fourier transform. Difference equation, trans		
	esign methods for finite impulse response (FIR) digital filters - windowing and frequency sampling methods, optimal design algorithms	-	-
half-band and narro	ow-band filters. Design methods for infinite impulse response (IIR) digital filters. Bilinear transformation. Analytic design methods in digi	tal z-domain. All-pa	ss sections
	as building blocks for signal processing. Group delay equalization, phase shift and notch filters. Wave digital filters.		
XP31DSP	Digital signal processing	ZK	4
	s on the basic courses of digital signal processing in master's degree, develops and deepens the knowledge corresponding to the ne		
	processing. It covers spectral and cepstral analysis, parametric methods, optimal LTI filters, frequency analysis, methods of analysis of		
XP31FSK	Phonetic signals and their coding	ZK	4 evethesis
	uces the processing of speech signals. Within the subject students should manage from basic to advanced and modern algorithms o nent. Further reasonable part is focused on speech recognition, where students will get to know modern and advanced technique in task		-
-	on or speaker recognition. Special attention is devoted to usage of classification techniques based on GMM, DTW, HMM, ANN/DNN,	-	-
XP31NOS	Design and circuit structures of electronic systems	ZK	4
	ith important applications of analogue technique. The subject is divided into the three basic parts. The first part is devoted to amplifier		
	and signal processing. Special application amplifiers, nonlinear and parametric analog functional blocks and fast analog circuits opera	_	

discussed. The second part is devoted to linear analog systems, their characteristics, description and synthesis capabilities. There are discussed: the types of filters and their field of application, methods of filter synthesis and their optimization with regard to real properties and value variances of the circuit elements, implementation of active filters, including discrete-time filters, i.e. switched capacitor (SC) and switched-current (SI) circuits. The last part deals with computer-aided circuit design. The principles of modeling of the analyzed system, including models of functional blocks and circuit elements are discussed together with simulation result processing and their utilization for circuit design and optimization. XP31TSS Signal and system theory 7K Signals and transformations - Laplace and Z-transforms, Fourier transform, cepstra, wavelet transforms. Signal parameterization - AR, MA, ARMA models, LPC cepstrum. Signal classification - spectral distances, Markov models, neural nets, signal prediction. XP31ZBS Biological Signal Processing The course deals with the processing of biosignals and advanced methods of processing resulting from current research in solving common projects in cooperation with top institutions (medical faculties, institutes of the ASCR, foreign universities). The subject concept allows us to respond flexibly to new directions and knowledge in the field. XP32AKR Applied Cryptography Introduction to Cryptography.Mathematics Foundations of Cryptography.Related Problems of Number Theory.Public Key Parameters. Pseudorandom Bits and Sequences. Stream Ciphers. Block Ciphers. Public Key Enciphering. Hash Functions and Data Integrity. Entity Identification and Autentication. Digital Signatures. Key Management Protocols. Key Management Techniques. Effective Implementations of Supporting Algorithms. Patent Pendings and Standards. XP32DZS Digital Signal Procesing in Telecommunications ZK 4 XP32MOS Mobile Networks ZK 4 The course familiarizes students with evolution and standardization of mobile networks and mainly provides a detailed description of network architectures and discusses basic principles used in mobile networks. The course as well depicts trends and the future development of mobile networks. XP32NMR Numerical Methodes of Electromagnetic Tasks Solution The subject deals with analysis of electromagnetic field distribution through both air and other environment. It offers a view deep inside to popular numerical methods as Finite Difference Method, Boundary Element Method and Finite Element Method. Handling the software is obvious nowadays; nevertheless, the mayor attention is paid to understanding the mathematical background of the used apparatus and understanding the physical principles of the solved tasks in symbiosis to particular used software. Telecommunications Systems Management ZK Telecommunications Systems Management is a discipline which deals problems of interactions of technical and business aspects of management of telecommunication networks and services provided. XP32TPZ Teletraffic Theory ZK The aim of the course is to present an overlook of dimensioning of telecommunications networks on the basis of results of the queuing theory (QT). Introduce possibilities of simulation and modeling networks both from the point of view of grade of service GoS and quality ofservice QoS as well. Results of the QT are applied on different service systems and telecommunication networks deploying and operating at time being. Theoretical knowledge about models of service systems can be utilized for dimensioning of different service systems in real life - not only in the telecommunication. XP33BID **Bionics** 7K Relationship: biology + technology = bionics. Bionics Classification. An overview of biological principles and its technological parallels: reproduction, growth, movement, breathing, heart action, digestion, excrementation, thermoregulation, vision, hearing, taste, smell, sense of touch, speech, memory. Neural and neuronal systems. Motion control. Biosensors and sensors for robotics. Information transfer in biotechnological systems, Biosystems modelling, Biosystems diagnostics, Orientation and navigation, Functional supports, internal and external substitutes, bioprotheses. Artificial organs and its control. Intelligent interaction and communication in biotechnical systems. Intelligent input and output filters. Support system for creative thinking. XP33DID Distributed Artificial Intelligence 7K 4 In winter semester 2023/24 the course runs for the last time. In future years, it will not be opened anymore. Distributed problem solving. Multiagent planning. Cooperation. Coordination. Communication. Communication strategies, message passing. Various Al approaches, case studies. Types of agent behavior. Negotiation. Organizational structuring. Partial global planning. Blackboard systems. Client-server systems. Peer-to-peer systems. Implementation aspects of distributed knowledge-based systems. Learning in multiagent systems. Meta-agent. Agents acquitance models, social knowledge, reflectivity in MAS. Coalition formation, team work. Formal models of agent architecture. **Evolutionary Computing** Introduction to evolutionary computing in contrast to classical computing techniques, Genetic algorithms (GA) for optimisation. The Simple Genetic Algorithm (SGA) and its behaviour. GA Convergence, negative phenomena. GA and constrained tasks, special representations. Genetic Programming (GP), relationship to GA. GP typical tasks, GP and machine learning. GA and GP applications. Special methods for improving GA performance. XP33FLO Fuzzy Logic ZK 4 Basics of fuzzy sets and fuzzy logic. Measures on collections of fuzzy sets. Principles of fuzzy control. XP33GAD Geometrical Algebras ZK 4 Algebraic structures used in geometry: Groups and linear spaces, ordered groups and fields, othogonal groups, Clifford algebras, etc. Discussion of potentital applications in image processing. XP33ICT Modern ICT for Industry and Smart Grids ZK 4 XP33IMD ZK Informatics in Clinical Medicine Medical data processed by automatized systems. Specific problems of medical informatics. Computer supported documentation in doctor's work. Hospital information systems. Requirements on information system projects from the point of view of medicine. Introduced hospital information systems. Diagnosis theory, computer aided diagnosis. Knowledge-based systems and their application in medicine. Database systems, biomedical databases. Computers in clinical biochemical laboratories. Computers in metabolic and intensive care. Computer aided therapy planning. Standardiyation and communication between information systems in medicine. Specialized computer networks. XP33KSI Sotware Engineering - Selected chapters XP33LPD Logic and Logic Programming ZK 4 Mathematical logics and its relation to technical disciplines. Formal system and its essential properties - validity, completeness. Syntax and semantics, basic definitions. Compactness theorem. First order language and its interpretation. Theory and its model, Herbrand's model. Herbrand's theorem, Gödel's completeness theorem and their practical implications. Limits of computability and probability. Logic programming and Prolog language. Metodology of logic programming. Introduction of extralogical features and metapredicates. New trends - constraint logic programming (CLP) and inductive logic programming (ILP). Some practical examples of complex logic programs and practical applications. Mathematics for Cybernetics - Selected Topics XP33MKD Overview of modern mathematics. Ordering, lattices, Boolean algebras, representations. Topological spaces. Metric spaces, completeness, fixed-point theorem with applications, fractals. Linear spaces, constructions with linear spaces. Systems of linear equations, spectral theory. Matrix calculus, matrix inequalities. Least squares and singular value decomposition. Tensor product. Elementary theory of Hilbert spaces. Introduction to category theory. XP33MOL Modal Logics for Distributed Systems ZK A model of knowledge in distributed environment and "muddy children puzzle". Introduction of modal operators and their semantics based on possible-worlds model. Properties of knowledge. Correspondence between axioms and properties of possibility relation in the model. Knowledge in MAS. Common knowledge and agreement.

XP33NUM	Numerical Analysis	Z,ZK	4
	ces to basic numerical methods of interpolation and approximation of functions, numerical differentiation and integration, solution of transfer to be a second of the contract	•	- 1
partial) differentia	al equations and systems of linear equations. Emphasis is put on estimation of errors, practical skills with the methods and demonstra Maple and computer graphics.	tion of their proper	ties using
XP33PAD	Probabilistic Algorithms	ZK	2
	notions of statistic and probability. An analysis of the notion of non-deterministic algorithm. Effectivity criteria for non-deterministic algorithm.		
-	prithms. The probability of failure. Loss function. The expected risk. Probabilistic analysis of deterministic algorithms. Criteria for applications and the control of the		
	Probabilistic algorithms and their practical importance.		
XP33PAM	Industrial application of multi-agent systems	ZK	4
XP33PMD	Probabilistic Models of Uncertainty in Al	ZK	4
	sbability. Foundations of graph theory. Triangulated graphs and their characteristics. Information as a measure of dependence. Conditional ependence Lemma). Knowledge representation by multidimensional distributions. Qualitative knowledge represented by dependence		
Lemma, block mu	models and Bayesain networks. Decomposable models for computation in Graphical Markov models. Examples of application	•	cai iviai kov
XP33PPD	Practical Data Mining Problems	ZK	4
	sed on solving of practical data mining problems. Lectures deal with data transformation, pre-processing and verification, selection of a		g algorithm
and data mining	process evaluation and results interpretation. The attention is paid to solving of an individual data mining problem based on real-life d	ata under supervis	ion of the
VD22DLID	lecturer.	71/	
XP33PUD Natural language	Artificial Intelligence communication with a computer, phases of processing, syntactic analysis, grammars including DCG. Understanding a sentence, sem	ZK antic support of an	4 alvsis and
	ganization. Knowledge engineering and knowledge elicitation. Machine learning -review of methods and tools. PAC learning. Learning is		- 1
	and scheduling.		
XP33RMD	Control of Mobile Robots	ZK	4
	t Mobile Robots. Known Control Architectures. Top-Down and Bottom-Up Approaches. Overview and Comparison. Distributed Autonom		٠ ا
_	phbourhood Mapping. Needed Sensors. Ground of Ethology. Imprinting. Taxe. Stimuli, Receptors. Multiple Motivated Behaviour. Reacti nunity Robots Structure. Task- or Behaviour-Oriented Robots. Ways and Realisation of Robots Co-operation, Motivation, Observation,	-	
0	lti-Agent reinforcement Learning. Q-Learning. Action Selection Mechanism, Learning Method, Exploration Strategy. Emotional Learning		
	thetic Biology. Artificial Life. Virtual World Different Approaches. Robots Competition, RoboCup, Strategy Selection, Implementation. C)pen Problems.	
XP33ROD	Pattern Recognition	ZK	4
VP00P07	See https://cw.fel.cvut.cz/wiki/courses/xp33rod/start	714	
XP33ROZ	Selected Topics in Pattern Recognition	ZK nonlinear Fisher dis	4 criminant
-	g theorz. Deterministic learning. Unsupervised learning: Robbins algorithm and emprirical Bayesian approach. Expectation-minimization		
	sequences and directed acyclic graphs. Markov models. Combination of weak classifiers: boosting and bagging. AdaBoost	<u> </u>	
XP33RSK	Robust Statistics for Cybernetics	ZK	4
	ds are basic tools of control and decision making theory. Classical statistical methods (e.g. MLE) are usually very sensitive to deviation ds which are robust have been developed. It means that these methods are not so sensitive to small deviations from an underlying mo		
=	sept of estimation and then we introduce the robust approach, some basic robust estimators of location (e.g. trimmed mean, Hampel e	=	
•	robustness (influence function, breakdown point).	,	
XP33SCD	Man-Machine Systems	ZK	4
=	chine systems development. Human operator tasks. Manual control, supervisory control cognitive control. Typical structure of a control s	=	
	operator and machine. Control levels after Rasmussen. Skill based, role based and knowledge based operator behavior models. Fuz gy. Mental models. Human-machine interaction. Intelligent interface. Factors influencing operator behavior. Stress. Mental load. Human		
- p	system reliability. Man-machine systems simulators. User-centered system design.		
XP33TTM	Text mining	ZK	4
XP33UID	Artificial Intelligence	ZK	4
•	al issues. Knowledge representation: production systems, predicate logics, semantic nets, frames, and scenarios. Problem solving, sta	•	
	of the search algorithms. Expert systems for diagnostics and planning tasks. Uncertainty processing. Hajek's algebraic theory. Creation of sition, induction from examples. Distributed expert systems with the blackboard architecture, multi-agent systems. Backgrounds of pat	ŭ	Knowleage
XP33VID	3D Computer Vision	ZK	4
	spective geometry, perspective camera. Fundamental and essential matrices, their robust estimation, camera calibration. Correspond		
	scopic vision problem, cyclopean representation, disparity, disparity gradient limit, ordering constraint, four basic formulations of the de	-	
	reconstruction from stereovision, error propagation, examples. Physics of image reflection, image irradiance equation, basic reflectance		•
XP33ZPM	shading problem. Local shading analysis. Overview of other Shape-from-X methods. Up-to-date info at https://cw.felk.cvut.cz/doku.ph	ZK	4
XP33ZVD	Introduction to Computer Vision	ZK	4
XI 332 V D	The subject does not exist anymore. Its last lecture run in the academic year 2021/2022.	ZI	7
XP34APD	Advanced Power Semiconductor Devices and ICs	ZK	4
-	nological structures. Development trends. Parameters and applications. Bipolar structures. MOS structures. BiMOS structures. PN dio	-	- 1
transistors. MOS ar	nd IGBT transistors. Thyristors (including GTO and MCT). Secondary breakdown, mechanism, safe area. Smart-power devices. High volt	tage ICs, operation	, principles,
XP34AT	applications TCAD Tools Applications	ZK	4
	ן היינוסוס אף וויסטוס אף וויסטוס ne computer-aided technological design. Device simulators Atlas and Sentaurus: principle, applications. Basic equations. Boundary co		
	ation models. Avalanche ionisation models. Mobility models. Hands-on exercises on SUN workstations according to the tasks of stude		
XP34CNO	Integrated Optics	ZK	4
	hnological principles of IO Basic materials for IO. Light propagation in waveguide structures. Methods of waveguide structure design. Principles of IO Basic materials for IO. Light propagation in waveguide structures.	_	1
	ule structures. Modal spectroscopy. Fundamental physical effects and interactions for IO. Preparation of dielectric waveguides and str s. Electro-optical modulators. Applicable measurement methods. Devices based on nonlinear effects. Semiconductor integrated opto-e		- 1
XP34ETS	Electrical Transport in Semiconductors	ZK	4
	ansport in semiconductor crystals. Effective mass, mobility Boltzmann's transport equation. Scatter mechanisms, frequency. Scattering c	I I	-
	on. Relaxation time approximation Carrier transport in a strong electric field, velocity saturation. Carrier transport in magnetic field. Car	-	- 1
			·

structures. Quantum transport, density matrix, Green's and Wigner's functions. Resonance tunnelling, transport of electrons in superlattices. Single electron transport, Coulomb's blockade. Ballistic transport. Quantum Hall's effect. Simulation of transport effects. XP34IO **Integrated Optics** 7K 4 Light propagation in waveguide structures. Methods of waveguide structure design. Waveguide coupling elements. Gratings structures at waveguides. Fundamental physical effects and interactions for IO. Design and preparation of dielectric and polymer waveguides and structures. Optical waveguide gratings. Passive waveguide structures. Electro-absorption, electro-optical and thermo-optical effects and their use for IO. Structures for control of optical radiation. . Devices based on nonlinear effects. Semiconductor integrated structures, optical amplifiers. Optical components for informatics and sensors, multiplexing and optical processing. Applicable measurement methods, principles of nanophotonics and integrated optics application. XP34MSY Microsystems Fundamental concepts and classification of microsystems. Micro-sensors. Micro-actuators. Signal processing within the system. MEMS (micro-electrical-mechanical structures). MOES (micro-optical-electrical structures). MEMOS (micro-electrical-mechanical-optical structures). Microsystem design. Microsystem modelling. Manufacturing technologies. Materials. Industrial applications. Medical applications. Optical Radiation Detection and Detectors XP34ORD Spectrum of electromagnetic radiation, radiometric and photometric units. Detection of optical radiation. Ideal detectors, internal and external photo-effect. External photo-effect detectors, photomultipliers. Internal photo-effect detectors, PN junction. PIN photodiode, physical principles, properties. Avalanche photodiode, physical principles, properties. PN junction. physical principles, properties. Thermal energy conversion detectors. Bolometers, thermocouples. Pyroelectric detectors. Some other detector types. Optical receivers, design principles, properties, noise. Solar cells, properties. Measurement methods, applications. XP34PED Advanced Electronic Devices ZK 4 Energy band engineering. Quantum well, wire, point. 2D electron gas based devices (HEMT, MOD FET). Devices based on resonance double-barrier tunnelling. 3D structures. Quantum device applications (memories, generators, multipliers). Heterogeneous structures. Microwave devices, HBT, Gunn diodes. Microwave device applications. Heterogeneous devices with internal optical coupling. Cryotronic devices. Recording media. IC development trends. XP34PIC Programmable IC Design The aim of the course is to acquaint students with advanced methods of design, synthesis and verification of programmable systems and systems with high integration on the chip. Students will learn the basic building elements, architecture and design procedures used to implement complex integrated systems, methods of describing them, and procedures their synthesis. They will learn verification strategy, design and analysis of tests. This project-oriented course would with the use of state-of-the-art EDA tools to implement a comprehensive programmable integrated system whose application would be linked to the topic of the dissertation. XP34SRS Semiconductor Radiation Sources ZK Stimulated emission in semiconductors. Homogeneous and heterogeneous junction, double heterostructure lasers and LEDs. Non-coherent LED's, super-luminescence diodes. Electromagnetic fields in semiconductor lasers. Types of lasers and their properties. Waveguide lasers, DFB and BFR structures. SQW and MQW lasers, quantum wells. Tunable injection lasers. Spectral line width and line stability. Radiating characteristic, coupling of the radiation source to a waveguide. Bi-stable and memory elements and switches. Semiconductor injection, waveguide amplifiers and wave convertors. Lasers and non-coherent diodes for optical communications. Measurement methods, applications. XP34STV VLSI Structures and Technologies Functional structures of the IC's. Bipolar and unipolar structures. BiCMOS structures. 3D structures. Sub-micron structures. Memory structures. Testing structures. VLSI technological processes. Advanced semiconductor technology. IC design, design of technology. Design rules. Reliability, yield. Outlooks and limitations of IC development XP34TOS Technology of Optical Devices Preparation of optoelectronic materials and structures. Diagnostic and testing methods. Design and preparation of double heterostructures. Preparation of semiconductor waveguides. Preparation of LED's, lasers, photo-resistors. Preparation of QW structures. Design of dielectric waveguide structures. Preparation of dielectric waveguide structures. preparation of optical radiation distributing structures. Design and preparation of optical radiation control structures. Measurement methods. Testing methods. Examples of semiconductor structures. Examples of dielectric structures. XP35CCM Cooperative Control of Multi-agent systems ZK 4 Cooperative distributed control is a relatively novel and rapidly developing area of control theory and engineering. Instead of centralized, large systems are considered composed of autonomous subsystems, with local computation and communication capabilities. The broad aim is solving classical problems e.g. stabilization, tracking, estimation and optimization, via local communication and team cooperation robust to changes in communication topology and disturbance. Relevant topics of classical control theory are revisited and a brief review of background mathematics needed for the course is also provided. The potential use of multi-agent cooperation in challenging applications involving environment to be controlled or observed is discussed. Theory: Review of qualitative properties of dynamical systems, Motivation for distributed multi-agent systems, Elements of algebraic graph theory, Distributed estimation and control, Consensus and synchronization of linear/nonlinear, continuous/discrete-time systems, Cooperative stability, optimality and robustness, Distributed optimization: multi-player game theory, Interactions with environment. XP35FMD Fuzzy Modelling and Control ZK 4 The goal of the subject is to introduce the up-to-date trends and results in the area of modelling and control of nonlinear systems based on fuzzy logic and neural networks. This includes especially analysis and synthesis of Takagi-Sugeno fuzzy systems, utilization of fuzzy systems and neural networks in control of nonlinear systems by approximation of unknown functions appearing in the description of the system, and design of adaptive fuzzy systems both direct and indirect. XP35LMI Linear Matrix Inequalities ZK 4 Semidefinite programming or optimization over linear matrix inequalities (LMIs) is an extension of linear programming to the cone of positive semidefinite matrices. LMI methods are an important modern tool in systems control and signal processing. Theory: Convex sets represented via LMIs; LMI relaxations for solution of non-convex polynomial optimization problems; Interior-point algorithms to solve LMI problems; Solvers and software; LMIs for polynomial mehods in control. Control applications: robustness analysis of linear and nonlinear systems; design of fixed-order robust controllers with H-infinity specifications. For more information, see http://www.laas.fr/~henrion/courses/lmi XP35LSD **Linear Systems** This course builds upon the master program lectures on Dynamical Systems Theory. The structure and properties of linear multi-input multi-output systems are studied. The significance of these results for the design of linear controls is demonstrated. The presentation focuses on pole placement techniques, linear state regulation and estimation, and LQG control design. State-space and transfer-function design techniques are compared. The lectures are supported by laboratory experiments using Matlab, Control System Toolbox, and Polynomial Toolbox. XP35NES Nonlinear Systems This course constitutes a continuation of the master level course "Nonlinear systems" being opened during winter semester. It is devoted to the detailed study of nonlinear systems structure from the control design point of view. It is based on state space descripion of nonlinear systems. Model transformations will be studied to simplify them and thereby faciliate the controllers design. It gives mathematical conditions for the existence of these transformations. Nonlinear analougues of controllability and observability will be introduced and studied as well and their relation to detectability and stabilizability investigated. Finally, elements of nonlinear output regulation as well as of nonlinear robust and adaptive design will be presented. Exercises will be, in particular, based on MATLAB and SIMULINK use. XP35OFD Estimation and Filtering Methodology: experiment design, structure selection and parameter estimation. Bayesian approach to uncertainty description. Posterior probability density function and point estimates: MS, LMS, ML and MAP. Robust numerical implementation of least squares estimation for Gaussian distribution. Parameter estimation and state filtering - Bayesian approach. Kalman filter for white noise. Properties of Kalman filter. Kalman filter for colored/correlated noise.

XP35RRD	Robust Control Advanced course on selected topics in robust control.	ZK	4
XP36ASP	Architecture of Symbolic Computers	ZK	4
	ns and abstract programs, lambda calculus, formal basis for abstract programming, self-interpretation, SECD abstract machine, memory	_	
	elementations, predicate logic and its inference engine, Prolog inference engine and dynamic algebras, Warren abstract machine, optimis parallel inference engines.		
XP36DRO The subject	Diagnostics and Reconfiguration of Programmable Circuits is aimed to help PhD students to understand better methods of reliability and availability improvement of SOC and NOC circuits built	ZK on FPGAs and	ASICs.
XP36DSY	Distributed Systems	ZK	4
	echanisms - message exchange, procedural communication (RPC, ORB), distributed shared memory. Process algebras - CSP, CCS ets. Distributed execution, global state, causality, logical time. Algorithms of: exclusive access, leader election, deadlock detection/pr	-	1
,	resiliency, qourum algorithms, replication. Mobility, search in distributed systems - DHT.		,
XP36HS Hypermedia syster	Hypermedia Systems and Internet Computing ms, basic models. Intelligent searching, adaptive navigation, personalization of access to web applications. Web intelligence, semantic topics and the wave out Internet computing Modern topics for web applications design.	ZK c web. Web eng	4 ineering, main
XP36JAI	topics and the ways out. Internet computing. Modern technologies for web applications design. Languages for Artificial Intelligence	ZK	4
	rs a deep insight into the two programming languages that are most frequently used in the domain of artificial intelligence (Lisp, Prok paradigms used to build typical AI algorithms and gives some basics concerning the implementation of the two languages	og). It exhibits pr	1 1
XP36KP	Communication Protocols	ZK	4
•	otocol principles, SDL language, protocol architecture: ISO OSI, error control, data-link layer protocols: X.25, higher layer protocols (T implementation tools (FSM language ESTELLE, regular grammars), use of Petri nets, specification language LOTOS, protocol transf validation and verification of protocols.		- 1
XP36LSM	Logical Simulation	ZK	4
	n to simulation: fundamental ideas and principles of simulation systems, synchronous and asynchronous simulation. Simulation system data types, entities, architectures, sequential environment (processes, functions, procedures), signals and their attributes, resolution		
or digital circuits. (data-flow description, blocks, structural description), configuration of structural models. Students who completed course 36SIM car	-	environment
XP36NSN	Neural Networks and Neurocomputers	ZK	4
_	ound, paradigm classification and artificial neural networks learning methods. Student is supposed to propose and test the application		
	oncerning his dissertation theme during the semester. Procedure and results would be concluded in the preliminary publication form a scientific forum.		
XP36PAS	Algebraic Specifications Prototyping ication, syntax and semantics of a specification language (OBJ3), structured specifications, generic specifications, implementation o	ZK	4
	Prolog, translation into Lisp, term rewriting systems, abstract rewriting machine, prototyping of a specification, prototyping in OBJ3, con (C++).		
XP36POA	Advanced Parallel Algorithms	ZK	4
	sis of time-, and cost-efficient PRAM algorithms and parallel algorithms for distributed memory machines. The collection of algorithm		
XP36PSV	ithms, distributed list ranking, Cole's MergeSort, optimal mesh sort, connected components, tree contraction and tree evaluation, pat Parallel Systems and Algorithms	ZK	4
	sures and scalability of parallel algorithms. Parallel computer architectures, models, PRAM, APRAM. Direct and indirect interconnec	1	' '
	nunication algorithms - routing, switching techniques, deadlock problem, permutation routing, collective communication operations. Furnitudes of the computation, Euler tour technique. Parallel sorting. Parallel linear algebra algorithms. Parallel combinatorial search. Parallel complexity the computation, Euler tour technique.	•	-
XP36RGM	studies in specialization Computer Science and Informatics FEE CTU cannot register. Reading group in data mining and machine learning	ZK	4
Data mining (DM) a to be solved. Th	ims at revealing non-trivial, hidden and ultimately applicable knowledge in large data. Data size and data heterogeneity make two ke e main goal is to understand the patterns that drive the processes generating the data. Machine learning (ML) focuses at computer a	by data mining te algorithms that c	echnical issues an improve
•	gh experience and by the use of data. It often puts emphasis on performance that the algorithms reach. The distinction between DM a ed as a means of conducting useful data mining. For this reason, we cover both the areas in the same course. The main goal of the c		
<u> </u>	advanced and modern topics in the field.		,
XP36RSY	Reconfigurable Systems	ZK	4
=	reconfigurability as a part of normal function. Technology of reconfiguration., partially reconfigurable devices. Reconfiguration control a ems, software support. Design and verification of reconfigurable systems, algorithms, EDA tools. Reconfiguration in System on Chip (Seminars, experiments with reconfigurable devices, case study, literature research.	_	
XP36SEP	Seminars on Architectures of Parallel Computers	ZK	4
	ectures of high-performance computers and trends in technologies. Memory coherence and sequential consistency models. Shared- based cache coherence protocols and synchronization mechanisms. Virtual shared memory architectures: distributed cache-coheren	=	
XP36STR	mechanisms - barriers. Clusters: fast communication networks and protocols.	ZK	4
	Stringology ogs and sequences. General, ordered alphabet. Generalized and weighted strings. Finite and infinite alphabet. Searching in text, dicti	ı	' '
and approximate ma	atching. Forward and backward matching. Searching in compressed text. Searching in more-dimensional text. Searching for longest comr Searching for regularities in text. Construction of covering of text. Representation of text, prefix, suffix and factor automata, suffix trees	non factors and s	
XP36VAP	Advaced Computer Architecture	ZK	4
-	rallelism (pipelined, superpipelined and superscalar systems). Basic limitations to parallelism (structural, data and control hazards). I out of order). Register data flow, software and hardware solutions, interlocking, scoreboard, control stack. Memory reuse, register renan		
•	performace evaluation, HPCC, supercomputers. Shared memory multiprocessors (bus, switch, switched memory). Interconnection s	-	-
	ultiprocessor systems. MIMD systems UMA, NUMA, COMA. Distributed memory multiprocessors (crossbar switch). Data flow systems special architectures.	_	. Accelerators,
XP36VPD	Selected Parts of Data Mining	ZK	4
-	t revealing non-trivial, hidden and ultimately applicable knowledge in large data. This course focuses on two key data mining issues: da large data, it is important to resolve both the technical issues such as distributed computing or hashing and general algorithmic com		
will be motivated m	ainly by case studies on web and social network mining. The second part will discuss approaches that merge heterogeneous prior k will make the main application field here. It is assumed that students have completed the master course on Machine Learning and Di	nowledge with m	neasured data.
	<u> </u>		

P37AEM	Acoustic and Electroacoustic Measurements	Z,ZK	4
surement of aco	pustic pressure, measuring microphones. Measurement of acoustic impedance. Foundamental audiometric measurements, artificial	ear. Measuremei	nt of acoustic
er. Methods of ca	alibration of measuring microphones. Method of reciprocity. Method of reciprocity in the field of the spherical wave, in the diffusion so	ound field. Calibra	ition methods
	and sensors of velocity and displacement. Measurement of mechanical impedance, impedance head, artificial mastoid. Electrostatic		
	ctroacoustic measurements. Measurement of thin membranes and air-gaps. Acoustic intensity measurement. Measurements of acou		
(P37APF	Acoustics and Electroacoustics of Solid State	Z,ZK	4
	optropic unbounded continuum. Wave equation. Scalar and vector potential. Plane harmonic uniform and non-uniform wave. Energy a		
	in half-space, reflection and refraction of a plane wave at an interface between too solids. P-wave, SV and SH waves. Rayleigh wave ation in cylindrical wave-guide. Solid-state waveguides of non-uniform cross-section. Piezoelectricity. Equivalent circuits of piezoelect		-
is. Wave propage	of volume and surface waves.	and transducers i	or generation
XP37AR	Speech Acoustics	ZK	4
	tract, anatomy, physiology. Vocal cords, production of speech. Types of phonems. Speech analysis and synthesis. Automatic recogn		
(P37ARA	Architectural Acoustics	ZK	4
	etrical and statistical acoustics. Acoustical lining and sound absorption. Objective room acoustic parametres. Subjective criteria for a		1
ustics measureme	nent technique. Physical modelling and numerical simulation of sound propagation. Electroacoustic sound reinforcement. Acoustical pro	perties of building	gs: absorption
ound, sound insul	ulation. Simple and complex constructions. Criteria for sound insulation properties of building constructions. Measurement in acoustics	of constructions	. Calculations
	in room acoustics.		
(P37DRS	Satellite communication and navigation systems	Z,ZK	4
	ication - overview. Systems for fixed and mobile service. Satellite networks: Intelsat, Eutelsat, Inmarsat, Intersputnik, Astra. Orbits (L		
	te communication channel. Energetic budget of satellite link. Satellite link design. Frequency bands. Modulations and multiplexes: TDN		-
ctrum communica	ation. Systems VSAT, DAMA, DVB-S, S-UMTS. Multimedia satellite services. Satellite navigation systems: GPS, GLONASS and GAL	ILEO. Satellite co	mmunication
/D2751 ^	and navigation systems integration - CNS systems.	71/	
(P37ELA	Elastoacoustics with interactions of elastic structures with gaseous medium, namely vibrations of plates, radiation impedances, modal equations, inf	ZK	4 urrounding
ie course deals v	acoustic space, finite element method, calculation of eigenfrequencies.	nuence or waits s	urrounding
(P37FHA	Physiological, Psychological and Musical Acoustics	ZK	4
I I	ן ring organ, hearing theory, hearing field, loudness, masking, pitch of sound, temporal tresholds, distortion in the hearing organ, adap		1
' -	m. Binaural hearing, objective and subjective properties of musical signals, statistical and dynamical analysis. Perception of simple to	_	-
	issonancy. Psychoacoustics of transmission of the musical signal. Methods of psychoacoustic measurements, their validity, repeatab		
	of listening tests, methods of statistical analysis of results, interpretation.	, 3	
P37FHA1	Physiological, Pychologycal and Musical Acoustics 1	ZK	4
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operties of music	cal signal in temporal and frequency domains, methods of sound synthesis, timbre and interpretation of sound spectra, objective ass	sessment of timb	re, theory of
	cal signal in temporal and frequency domains, methods of sound synthesis, timbre and interpretation of sound spectra, objective ass uction to acoustics of speech and singing, physicalacoustic principles of musical instruments, tuning, dynamics, timbre of the tone, i		
	uction to acoustics of speech and singing, physicalacoustic principles of musical instruments, tuning, dynamics, timbre of the tone, I		
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KP37FOS age and its represability image des	uction to acoustics of speech and singing, physicalacoustic principles of musical instruments, tuning, dynamics, timbre of the tone, instruments, introduction to methodology of measurement of musical instruments. Photonic Imaging Systems essentation. Energetic image description. Principles of image acquisition, transferring and storing. Image entropy function, 2 dimension escription. Novel compression techniques. Image reproduction, matrix description. Light diffraction. 2D transfer functions - PSF, MTF,	ZK nal autocorrelatic PSF, MTF of real	4 on curve and I imaging and
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XP37SRP	Radio Receivers Special Technology	ZK	4
	vanced radio receivers technology. Basic structure classical and modern software defined radio receivers. Technical parameters radio		
radiobroadcasting a	and television receivers. Professional radiocommunication receivers and transceivers. Diversity techniques. Spread spectrum radio rec and broadband amplifiers. Oscillators and frequency synthesizers. Mixers and demodulators. Radio receivers system design		iairowbariu
XP37SZS	Statistical Signal Processing	Z,ZK	4
	ion and detection theory. General properties and fundamental limits. ML, LS, Bayes (MAP,MSE), NP, MM estimators and detectors. A		/ (Kalman,
	RLS). Iterative detection and parameter estimation.		
XP37TAS	Acoustic signal processing and theory	Z,ZK	4
-	lassification, sources, description of properties. Statistical analysis of acoustic signals. Spectral analysis of signals, Fourier transform e Fourier Transform, Wavelet transform, Wigner-Ville distribution. Cepstral analysis and its application in acoustics. Discrete signal pro		
=	npling, noise shaping . Granulation noise, dithering, signal requantization. Acoustic signal acquisition and data pre-processing. Impulse me		
	nalysis using swept and time delayed acoustic signals. Pseudorandom signals and their application in acoustic system analysis. Digital	processing of musi	cal signals.
XP37TEA	Theoretical Eletroacoustics	Z,ZK	4
	n fluids and solids. Systems of lumped and distributed parameters in solids. Equivalent circuits of membranes and plates. Reciprocal t reciprocal transducers (opto and thermoacoustical transducers, piezoresistive transducer). Electromechanical and electroacoustical		- 1
	s. Radiation, radiation impedance. Acoustic transmitters, directivity. Acoustic receivers. Acoustical systems with lumped and distributed e		
	air-gaps. Coupled systems.		_
XP37TMP	Medical Instrumentation	ZK	4
-	with principles and properties of medical systems for analysis of body fluids, blood gas analysis, medical minors of basic life functions		netry EEG,
XP37VKF	ermodynamic principles of anaesthetic equipment and equipment for artificial lung ventilation, haematological analysers and other me Selected Parts from Photonics	ZK	4
- 1	ology of vision. Integral photonic sensors. Panoramatic (image) photonic sensors. Integral photonic displays. Panoramatic photonic d		
	photonic elements. Basic elements of optical systems. Fundamentals of illumination. Fiber-optics elements and systems. Optical meth Optical (photonic) processors.		٠ ١
XP37VRA	Research Seminars in Radioelectronics and Acoustics	Z,ZK	4
The course is intend	ded for PhD students of the radioelectronics and acoustics specialization. It develops the presentation skills and serves as a platform	for discussion and	defence of
\\ _	students' research results.		
XP37ZI	Information recording Information recording topology topology the properties recording topology the properties are recorded to the	Z,ZK	4
-	ig theory. FM signal recording. Video information recording systems. High density recording, tape recorder thin heads. Impulse record -audio, DAT. Digital recording on CD-ROM, CD-video. WORM, CD-R recording. Erasable magneto-optical recording on MD. Digital vic		- 1
Ü	compression.	Ū	0,
XP37ZSN1	Signal processing in satellite navigation systems 1	Z,ZK	4
Distance measur	rement with pseudorandom signals and with carrier. Position determination based on measured distances. Time delay discriminator.	•	avigation
XP37ZSN2	receiver. GDOP, PDOP, HDOP, VDOP. GPS system, precision. Glonass and its precision. GALLILEO. Comparison of these syst Signal processing in satellite navigation systems 2	Z,ZK	4
	navigation systems, structure of receiver and precision of position measurement. Shortcomings of satellite systems: limited access a	,	
augmentation. D	Differential systems DGPS and DGLONASS, RTCM-104 standard. Systems SKY-FIX, FUGRO, RACAL, WAAS, EGNOS. GALILEO a	nd its prospective.	GPS III.
XP38EMC	Electromagnetic Compatibility of Data Acquisition Systems	ZK	4
EMC - basic terms.	Measurement of electromagnetic emission and immission. EMC standards. Modelling of disturbing signals. Electromagnetic disturbation of DAO systems with regard to EMC EMC of data transmitting lines.	nce in laboratory ar	nd industry.
XP38MDR	Design of DAQ systems with regard to EMC. EMC of data transmitting lines. Methods of Signals Digitalization and Reconstruction	ZK	4
	unconventional methods of analog preprocessing of typical sensors signals, selection of optimal digitization methods and optimization		•
•	of processing of measurement results to achieve high accuracy and effective suppression of disturbing signals.		
XP38MMN	Measurement of Nonelectric Quantities	ZK	4
	s of sensors. Measurement of temperature, pressure, flow, movement, position and other physical quantities. Chemical sensors and	-	
detectors, detection	on of explosives. New types of signal conditioning circuits. Sensor Applications in industry, transport and consumer electronics. Secu Sensor design and technology. Signal processing in sensor systems, intelligent sensors.	пцу апо пішагу ард	olications.
XP38MPM	Methods for Precision Measurement of Electrical Quantities and Measurement Data Processing	ZK	4
	of electrical quantities. Collective standards. Inductive ratio devices for precision electrical measurements and possibilities of improving	their metrological p	arameters.
Modern methods fo	or precision measurement of active and passive electrical quantities. Evaluation of measurement errors and uncertainties. Metrological	al reliability. Statistic	cal analysis
XP38MPX	of measurement data. Magnetics in Engineering Practice	ZK	4
	Magnetism in Engineering Practice roduced into the magnetic materials, magnetic sensors and engineering magnetism including FEM design and magnetic measureme		-
	this advanced course can be modified according to the students' needs.	J	
XP38PSL	Aircraft Instrumentation	ZK	4
	ints students with the current technology used in aircraft with respect to instruments, systems and sensors working in the low-frequent	=	
-	system data. The course includes a detailed description of aircraft instrumentation and its resistance to external influences, a descri I engineering, analysis of instruments and systems for measurement of engine and aerometric quantities, and a description of emergen	-	
•	background related to nowadays technology and methodology utilized on aircraft. The course provides a detailed overview of quanti	•	- 1
and analytical meth	nods and their integration into signal/data processing and aircraft system design principles. The last part of the course discusses the	current publishing a	activities in
VD20DLIO	the field of aircraft instrumentation.	フレ	
XP38PUC XP38SSB	Concore and Busine	ZK ZK	4
	Sensors and Buses introduced into the advanced topics of engineering sensors and sensor networks. Topics include: Sensor applications, physical principle		
	cept of smart sensors, measurement systems, analog circuits for sensor signal processing, sensor error correction, calibration and diag	= -	- 1
	immunity.		
XP38SYS	Measurement and Data Acquisition Systems	ZK	4
	ices the principles and technical means of data acquisition in the laboratory and industrial environment. Attention is paid to both hard In stems for data acquisition and process control. Laboratory exercises are designed in part in the form of classical tasks, partly in the f		
og.adoi: of by	in the field of programming of automated measurement systems and control of measurement processes.	O. p. ooloin one	

XP38VDI	Selected Chapters of Diagnostics	ZK	4
This course introd	uces advanced concepts of fault detection, isolation and diagnostics, signal analysis methods for machine condition monitoring, and p	orinciples and inst	rumentation
of non-destr	uctive testing, the corresponding advanced signal processing, and self-acting evaluation in order to improve reliability, availability, mai	ntenance, and life	-time.
XP38VKP	Selected Parts of Instrumentation	ZK	4
The course is dec	icated to principle, properties and applications of selected special measuring instruments. It deals mainly with calibrators and other s	ources of calibrati	on signals,
devices for measur	ement of extremely low voltage and current signals, lock-in amplifiers, power analyzers and electronic loads, devices used for EMC mea	surements, real-tir	ne spectrum
analyzers, metallic	and optical reflectometers and radio testers (Bluetooth, NMT, GSM, UMTS). A special part is devoted to sampling measurement metho	ds and virtual instr	rumentation.
XP38VKZ	Selected Chapters of Signal Processing	ZK	4
The course is de	dicated to advanced signals processing methods used in contemporary electronic devices and measuring instruments. It concerns e.	g. the other types	of integral
transformation (e	xcept Fourier), stochastic methods, processing of the multimedia signal, suppressing of unwanted effect, methods used for quality inc	reasing of multime	edia signal
	transmission, etc.		
XP39PMV	Advanced Methods of Visualization	ZK	4
Scientific visua	lization based on physical models. Scientific visualization and volume rendering. Volume graphics. Information visualization. Interactic	n in scientific visu	alization
env	ironment. Scientific visualization in WWW environment. Particle models and visualization of technological processes. Computational	fluid dynamics.	
XP39SPG	Computer Graphics Seminar	Z,ZK	4
The computer grap	hics seminar will cover selected research topics in computer graphics such as efficient rendering techniques, modeling of surface materi	als and their optica	al properties,
simulation of natura	al phenomena, geometrical modeling and animation. In the seminar we will also discuss computer graphics techniques used in relate	d research discipli	ines such as
0. 0	, computer vision and human computer interaction based on the particular topics of PhD theses of the participating students. The goa		
the sele	cted topics to the students and by analyzing selected highly influential research publications to further develop the research capabilit	ies of the students	S.
XP39VPG	Computational Geometry	ZK	4
Principles of comp	utational geometry (CG), data structures and paradigms, methods of geometric search, convex polygons and hulls, applications of co	nvex hull, proximit	ty problems,
Voronoi diagrams,	triangulation, efficient intersection algorithms, intersection of semispaces and polygonal regions, geometry of rectangles, dual mappir	ngs and spaces, c	onvex hull in
	dual space, algorithms of computer graphics and CG. Students who completed course 36VGE cannot enroll.		
XP39VR	Virtual reality	ZK	4
Advanced method	s in the VRML language. Standard and non-standard extensions to the VRML language. Programming of external applications with E	Al interface. Multi-	user virtual
	reality. Distant cooperation in virtual environment. Hardware and software support for virtual reality systems. QuickTime VR. Specific	ation X3D.	

For updated information see http://bilakniha.cvut.cz/en/FF.html Generated: day 2025-07-03, time 22:35.