Study plan

Name of study plan: Aplikovaná algebra a analýza

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

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

Code of the group: NMSPAAA1 Name of the group: MDP P_AAAN 1st year Requirement credits in the group: Requirement courses in the group: In this group you have to complete at least 11 courses Credits in the group: 0

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
01FAN3	Functional Analysis 3 Pavel Šoví ek Pavel Šoví ek (Gar.)	Z,ZK	5	2P+2C	Z	Ρ
01PDE	Modern theory of partial differential equations Mat j Tušek Mat j Tušek Mat j Tušek (Gar.)	Z,ZK	4	2P+1C		Ρ
01NELO	Nonlinear Optimization Radek Fu ík Radek Fu ík Radek Fu ík (Gar.)	ZK	4	3P+0C		Ρ
01TG	Graph Theory Jan Volec, Petr Ambrož Petr Ambrož (Gar.)	ZK	5	4P+0C		Ρ
01NAH	Theory of Random Processes Jan Vybíral Jan Vybíral Jan Vybíral (Gar.)	ZK	3	3+0	Z	Ρ
01TR1	Theory of representations 1 estmír Burdík estmír Burdík (Gar.)	ZK	2	2+0		Ρ
01TRE2	Representation theory 2 Severin Pošta Severin Pošta (Gar.)	ZK	5	4P+0C		Ρ
01URG	Introduction to Riemannian geometry David Krej i ík David Krej i ík David Krej i ík (Gar.)	ZK	2	2+0	Z	Ρ
01VAM	Variational Methods Michal Beneš Michal Beneš (Gar.)	ZK	3	1P+1C	Z	Ρ
01VUAA1	Research Project 1 estmír Burdík estmír Burdík estmír Burdík (Gar.)	Z	6	0P+6C		Р
01VUAA2	Research Project 2 estmír Burdík estmír Burdík estmír Burdík (Gar.)	KZ	8	0P+8C		Р

Characteristics of the courses of this group of Study Plan: Code=NMSPAAA1 Name=MDP P_AAAN 1st year

Functional Analysis 3	Z,ZK	5			
ional analysis needed for theory of representations of Lie groups and quantum theory. Compact operators, their ideals, unbou	inded selfadjoint o	operators, theory			
of symmetric operators, Stones theorem, quadratic forms and Bochner integral. The basics of Banach algebras and C*-algeb	oras.				
Modern theory of partial differential equations	Z,ZK	4			
efinition, completeness, examples. 3. Continuous and compact embedding theorems. 4. Trace theorem. 5. Weak solution (imp	ortance, derivatio	on of the weak			
DE of Second Order. 7. Existence and uniqueness of weak solutions (Lax-Milgram theorem). 8. Regularity of weak solutions	. 9. Relation to the	e calculus of			
quality. 10. Maximum principle for classical and weak solutions.					
Nonlinear Optimization	ZK	4			
onlinear optimization problems find their application in may areas of applied mathematics. The lecture covers the basics of mathematical programming theory with emphasis on convex					
nethods for unconstrained and constrained optimization. The lecture is supplemented by illustrative examples.					
	ional analysis needed for theory of representations of Lie groups and quantum theory. Compact operators, their ideals, unbound of symmetric operators, Stones theorem, quadratic forms and Bochner integral. The basics of Banach algebras and C*-algebra Modern theory of partial differential equations efinition, completeness, examples. 3. Continuous and compact embedding theorems. 4. Trace theorem. 5. Weak solution (imp DE of Second Order. 7. Existence and uniqueness of weak solutions (Lax-Milgram theorem). 8. Regularity of weak solutions quality. 10. Maximum principle for classical and weak solutions. Nonlinear Optimization roblems find their application in may areas of applied mathematics. The lecture covers the basics of mathematical programmin	ional analysis needed for theory of representations of Lie groups and quantum theory. Compact operators, their ideals, unbounded selfadjoint of symmetric operators, Stones theorem, quadratic forms and Bochner integral. The basics of Banach algebras and C*-algebras. Modern theory of partial differential equations Z,ZK efinition, completeness, examples. 3. Continuous and compact embedding theorems. 4. Trace theorem. 5. Weak solution (importance, derivation) DE of Second Order. 7. Existence and uniqueness of weak solutions. Nonlinear Optimization ZK roblems find their application in may areas of applied mathematics. The lecture covers the basics of mathematical programming theory with employees the basics of mathematical prog			

01TG	Graph Theory	ZK	5
1. Basic notion of graph	theory. 2. Edge and vertex connectivity (Menger Theorem). 3. Bipartite graphs. 4. Trees and forests. 5. Spanning trees (Matrix	k-Tree Theorem).	6. Euler tours
and Hamilton cycles. 7.	Maximal and perfect matching. 8. Edge coloring. 9. Flows in networks. 10. Vertex coloring. 11. Plannar graphs (Kuratowski the	eorem), vertex col	loring of planar
graphs. 12. Spectrum of	the adjacency matrix. 13. Extremal graph theory.		
01NAH	Theory of Random Processes	ZK	3
The course is devoted in	part to the basic notions of the general theory of random processes and partially to the theory of stationary processes and se	quences both wea	akly and strongly
stationary ones.			
01TR1	Theory of representations 1	ZK	2
Basic knowledge about	representations of groups, with emphasize given to finite groups.	'	
01TRE2	Representation theory 2	ZK	5
1. Basics of representati	ons of compact groups, Schur's lemma, orthogonality relations, Casimir operators. 2. Lie groups and algebras, matrix groups	s, one parametric	subgroups,
exponential map, group	SU(n) and their representations. 3. Decomposition of representations, Clebsh-Gordan coeficients. 4. Gelfand-Tsetlin bases, V	√erma bases 5. ľ	Representations
of groups and special fu	nctions. 6. Classification of irreducible representations of semisimple Lie algebras, Cartan subalgebra, roots, weights, lattices	, Weyl chambers.	7. Classical and
exceptional simple Lie a	Igebras, Dynkin diagrams. 8. Realizations of Lie algebras, Weyl algebras. 9. Representations of Lie superalgerbas, osp(1,2n)		
01URG	Introduction to Riemannian geometry	ZK	2
This lecture is intended	for an advanced undergraduate having possibly (but not necessarily) already taken a basic course on topological and difference	ntial manifolds. In	addition to
understanding the geom	etric meaning of curvature and its intimate relationship to topology, the student will learn the basic apparatus of Riemannian g	eometry suitable	for further study
of modern parts of math	ematics and mathematical physics. Possible extension of this lecture is the geometric analysis of partial differential equation	s on Riemannian	manifolds.
01VAM	Variational Methods	ZK	3
The course is devoted to	the methods of classical variational calculus - functional extrema by Euler equations, second functional derivative, convexity o	r monotonicity. Fu	irther, it contains
investigation of quadration	c functional, generalized solution, Sobolev spaces and variational problem for elliptic PDE's.		
01VUAA1	Research Project 1	Z	6
The research project is I	based on a topic approved by the administrators of the programme and by the head of the de-partment. The student is guide	d by the project s	upervisor during
common regular meeting	gs and discussions		
01VUAA2	Research Project 2	KZ	8
The research project is	based on a topic approved by the administrators of the programme and by the head of the de-partment. The student is guide	d by the project s	upervisor during
common regular meeting	gs and discussions.		

Code of the group: NMSPAAA2 Name of the group: MDP P_AAAN 2nd year

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 7 courses Credits in the group: 0

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
01ASY	Asymptotical Methods Ji í Mikyška Ji í Mikyška Ji í Mikyška (Gar.)	Z,ZK	3	2+1	Z	Р
01DPAA1	Master Thesis 1 estmír Burdík estmír Burdík estmír Burdík (Gar.)	Z	10	0P+10C		Р
01DPAA2	Master Thesis 2 estmír Burdík estmír Burdík estmír Burdík (Gar.)	Z	20	0P+20C		Р
01KOAL	Commutative Algebra Severin Pošta Severin Pošta (Gar.)	ZK	3	1P+1C		Р
01DISE	Diploma Seminar estmír Burdík estmír Burdík estmír Burdík (Gar.)	Z	1	0P+2S		Р
01TNM	Random Matrix Theory Jan Vybíral Jan Vybíral Jan Vybíral (Gar.)	ZK	2	2+0	Z	Р
01UTS	Introduction to the Theory of Semigroups Václav Klika Václav Klika Václav Klika (Gar.)	ZK	3	2P+0C		Р

Characteristics of the courses of this group of Study Plan: Code=NMSPAAA2 Name=MDP P_AAAN 2nd year

01ASY	Asymptotical Methods	Z,ZK	3
Examples. Addition par	ts of mathematical analysis (generalized Lebesgue integral, parametric integrals.) Asymptotic relations a expansions - proper	ties; algebraical a	and analytical
operations. Applied asy	mptotics of sequences and sums; integrals of Laplace and Fourier type.		
01DPAA1	Master Thesis 1	Z	10
The diploma project is t	pased on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the	project supervisor	during common
regular meetings and d	iscussions.		
01DPAA2	Master Thesis 2	Z	20
The diploma project is t	pased on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the	project supervisor	during common
regular meetings and d	iscussions.		
01KOAL	Commutative Algebra	ZK	3
1. Rings, ideals, homon	norphisms, prime and maximal ideals. 2. Rings of polynomials, symmetric polynomials, irreducibility. 3. Gröbner bases. 4. Poly	nomials with ratio	onal coefficients,
factorization of polynom	nials. 5. Hilbert's Nullstellensatz, ideals and manifolds, Krull dimension. 6. Fields, extensions, finite fields. 7. Introduction to Ga	lois theory, Galois	s extensions,
group and corresponde	nce.		
01DISE	Diploma Seminar	Z	1
In the first part of the se	minar, students familiarize themselves with the general principles of publishing and presenting scientific work and the formal	requirements for	diploma projects
at the faculty. The second	nd part is designed as a practical training for the defence of the diploma project. The students give oral presentations of the $lpha$	irrent state of the	research results
achieved during the wo	rk on their projects. Each presentation is followed by a discussion on scientific matters as well as on the possibilities of impro	ving the students	performance.

01TNM	Random Matrix Theory				ZK	2
	ces appeared first in 60's in the 20th century in connection with statistical physics and the					
for design of random alg	envalues of symmetric random matrices. In the 21st century the results of theory of rando gorithms.	m matrices were ap	plied in theo	retical comp	outer science a	nd numerics
01UTS	Introduction to the Theory of Semigroups				ZK	3
	n of linear ordinary differential equations can be solved by virtue of the matrix exponenti mple in the case of heat equation the matrix is replaced by Laplace operator which is not					
solutions of the heat equ	uation exist in general only for positive times and hence the solution operator can be at b	est a semigroup. Th	ne aim of the	e course is t	o provide a ma	
foundation for these type	es of problems and extend the concept of stability from ordinary differential equations, w	hich is again in rela	tion to spect	rum of a lin	ear operator.	
Name of the bl	lock: Elective courses					
Minimal numbe	er of credits of the block: 0					
The role of the	block: V					
Code of the ar	oup: NMSPAAAV					
-	roup: MDP P_AAAN Optional courses					
•	credits in the group:					
•	courses in the group:					
Credits in the g						
Note on the gr	oup:					
	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their			_		
Code	<i>members)</i> Tutors, <i>authors</i> and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
02ALT	Algebraic Topology	Z,ZK	4	2P+2C	Z	V
01ZASIG	Jan Vysoký Jan Vysoký Jan Vysoký (Gar.) Analysis and Processing of Diagnostic Signals	ZK	3	3+0		V
01ASM	Zden k P evorovský Zden k P evorovský Zden k P evorovský (Gar.) Application of Statistical Methods Taméš Labra Taméš Labra (Car.)	KZ	2	2+0		V
02COX	Tomáš Hobza Tomáš Hobza Tomáš Hobza (Gar.) Coxeter Groups Ji í Hrivnák Ji í Hrivnák Ji í Hrivnák (Gar.)	Z	2	2+0		V
18DDS	Database System Decomposition Dana Majerová, Jaromír Kukal Dana Majerová Jaromír Kukal (Gar.)	ZK	4	2P+2C	L	V
12DRP	Dana Majerova, Jaromir Kukai Dana Majerova Jaromir Kukai (Gar.) Differential Equations on Computer Richard Liska Richard Liska Richard Liska (Gar.)	Z,ZK	5	2+2	Z	V
01DIZO	Digital Image Processing Barbara Zitová Barbara Zitová Barbara Zitová (Gar.)	ZK	4	2P+2C		V
01DYNR1	Dynamic Decision Making 1 Ta jana Gaj, Miroslav Kárný Ta jana Gaj Ta jana Gaj (Gar.)	Z,ZK	3	2P+1C		V
01FIMA	Financial and Insurance Mathematics Joel Horowitz Joel Horowitz Joel Horowitz (Gar.)	ZK	2	2P+0C	Z	V
01SPEC	Geometrical Aspects of Spectral Theory David Krej i ik David Krej i ik David Krej i ik (Gar.)	ZK	2	2+0	L	V
01KOS	Compressed Sensing Jan Vybíral Jan Vybíral Jan Vybíral (Gar.)	ZK	2	2+0	Z	V
02KFA	Quantum Physics Michal Jex Michal Jex Igor Jex (Gar.)	Z,ZK	6	4P+2C	L	V
01KVGR1	Quantum Groups 1 estmír Burdík estmír Burdík (Gar.)	Z	2	2+0	Z	V
02KVK1	Quantum Circle 1 Pavel Exner (Gar.)	Z	2	0+2	Z	V
02KVK2	Quantum Circle 2 Pavel Exner (Gar.)	Z	2	0+2	L	V
04MGA1	English for Academic Purposes Speaking Practice - intermediate Darren Copeland Darren Copeland (Gar.)	Z	2	0+2	L,Z	V
04MGA2	Academic English Writing and Presentation Course - intermadiate Darren Copeland (Gar.)	Z	2	0+2	L,Z	V
01MAL	Mathematical Logic Petr Cintula Petr Cintula Petr Cintula (Gar.)	Z,ZK	4	2+1		V
01MMDY	Mathematical Methods in Fluid Dynamics 1 Pavel Strachota Pavel Strachota Pavel Strachota (Gar.)	ZK	2	2P+0C	Z	V
01MBM	Mathematical techniques in biology and medicine Václav Klika Václav Klika Václav Klika (Gar.)	Z,ZK	3	2+1	L	V
01MKP	Finite Element Method Michal Beneš Michal Beneš Michal Beneš (Gar.)	ZK	3	1P+1C	L	V
18MEMC	Monte Carlo Method Jaromír Kukal, Miroslav Virius Miroslav Virius (Gar.)	Z,ZK	4	2P+2C	Z	V

Orthomit Jr / Mayska Jr / Mayska Jr / Mayska (Car.) ICL Z Z Display 001NSN Neural Networks, Machine Learning, and Randomness Z,ZK 2 1P+1C v 030OP Object Oriented Programming Microsky Vinus Minus Minus (Gar.) Z 2 2C Z v 01PNL Advanced Methods of Numerical Linear Algebra ZK 2 2P+0C v 01UMIN Probabilistic Models of Artificial Intelligence KZ 2 2P+0C v 011PSM1 Probabilistic Models of Artificial Intelligence KZ 2 2P+0C v 011PSM2 Probabilistic Models of Mathematical Analysis Z 2 0P+2S Z v 011PSM2 Probabilistic Models of Mathematical Analysis Z 2 0P+2S Z v 011PSM2 Probabilistic Models of Mathematical Physics Z Z 2P+0C v v 012SVF Solvabile Models of Mathematical Physics (Gar.) KZ 2 0P+2C v v 01SW Studentris Scientific Conference Z 1 5 dni v v		Nothe de fan Onenes Noteines			1		
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Oxford Interface Value Markage Value L <thl<< td=""><td>01NSN</td><td>Neural Networks, Machine Learning, and Randomness</td><td>Z,ZK</td><td>2</td><td>1P+1C</td><td></td><td>V</td></thl<<>	01NSN	Neural Networks, Machine Learning, and Randomness	Z,ZK	2	1P+1C		V
On Num If Mayba if i Minyska if i Minyska (skr) Image in the image	1800P		Z	2	2C	Z	V
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Othersent Problem Seminar in Mathematical Analysis Z 2 0P+2S Z v 01PSM2 Problem Seminar in Mathematical Analysis 2 Z 2 2S v 01PSM2 Mar I Takes Mar I MarkI (Sen) KZ 2 2H-0 L V 01SWA Student's Scientific Conference Z 1 5 dni V 01SMS1 Student's Seminar in mathematics 1 Z 2 0P+2C L V 01SMS2 Student's Scientific Conference Z 3 2P+0C V 01TTCC Number Theory ZK 3 2P+0C V 01TTSF Information Theory ZK 3 2P+0C V 01TTRM Matri Theory East Mark Mark Mark Mark Mark Mark Mark Mark	01UMIN	Probabilistic Models of Artificial Intelligence	КZ	2	2+0	Z	V
Other Seminar in Mathematical Analysis 2 Z 2 2.8 V 02RMMF Solvable Models of Mathematical Physics Z 2 24-00 L v 02RMMF Solvable Models of Mathematical Physics Z 2 24-00 L v 01SWF Start-up Project Parrel Robot Parrel Robot Parrel Robot Gew / KZ 2 24-00 V 01SWK Student's seminar in mathematics 1 Z 2 0P+2C V 01SMS1 Student's seminar in mathematics 2 Z 2 0P+2C V 01SMS2 Student's seminar in mathematics 2 Z 2 0P+2C L V 01SMS2 Student's seminar in mathematics 2 Z 2 0P+2C L V 01TMF Information Theory Torons Models and Maskowi Zuzane Mask	01PSM1	Problem Seminar in Mathematical Analysis	Z	2	0P+2S	Z	V
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D1SMS1 Student's seminar in mathematics 1 Z 2 0P+2C v 01SMS2 Student's seminar in mathematics 2 Z 2 0P+2C L v 01SMS2 Student's seminar in mathematics 2 Z 2 0P+2C L v 01SMS2 Student's seminar in mathematics 2 Z 2 0P+2C L v 01TEC Number Theory Zurane Maskiowi ZK 3 2P+0C v 01TINF Information Theory ZK 3 2P+0C v v Characteristics of the courses of this group of Study Plan: Code=NMSPAA4V Name=MDP P AAAN Optional courses ZZX 4 A study of modern mathematical aperatus. The main goal of this course is to acquire a veri increasing two/edge of mathematical aperatus. The main goal of this course is to acquire a veri increasing two/edge of mathematical aperatus. The main goal of this course is to acquire a veri increasing two/edge of mathematical aperatus. The main goal of this course is to acquire a veri increasing two/edge of mathematical aperatus. The main goal of this course is to acquire a veri increasing two/edge of mathematical aperatus. The main goal of this course to acquire a veri increasing of Diagnostic Signals ZK 3 D1ZASIG Analysis and Pro	01SVK	Student's Scientific Conference	Z	1	5 dní		V
DISMS2 Student's seminar in mathematics 2 Z 2 0P+2C L V OTTEC Number Theory Zurane Massikové ZURANE Melavitová ZURANE Massikové ZKK 5 4P+0C V OTTINF Information Theory Zurane Massikové ZURANE Massikové ZKK 5 4P+0C V OTTINF Information Theory Z 3 2P+0C V OTTEMA Matrix Theory Z 3 2P+0C V Characteristics of the courses of this group of Study Plan: Code=NMSPAAAV Name=MDP P_AAAD Optional courses ZZ/X 4 A study of modern mathematical and theoretical physics requires one to acquire an ever increasing knowledge of mathematical algebra and cohonology. A important bioscurs is to acquire an ever increasing knowledge of mathematical algebra and cohonology. A important bioscurs is to acquire a ever increasing knowledge of mathematical algebra and cohonology. A important bioscurs is to acquire a ever increasing knowledge of mathematical algebra and cohonology. A important bioscurs is to acquire an ever increasing knowledge of mathematical algebra and cohonology. A important bioscurs to acquire a section the ever section and the ever section and ever section and ever section the ever section and ever section and ever section the ever section and ever section	01SMS1	Student's seminar in mathematics 1	Z	2	0P+2C		V
DITEC Number Theory Zuzana Maskowi Zuzana Maskowi ZK 5 4P+0C v 011TINF Information Theory Tonds Hobzer ZK 3 2P+0C v 01TEMA Matrix Theory Edita Z 3 2P+0C v 01TEMA Matrix Theory Edita Z 3 2P+0C v Characteristics of the courses of this group of Study Plan: Code=NMSPAAV Name=MDP P_AAAN Optional courses O2ALT Algebraic Topology ZX 4 A study of modern mathematical language by concepts appearing universally across disciptines like differential geometry and abtract algebra. During exercise sessions, students will by practice calculations of introduced mathematical and theoretial physics requires one to acquire a ever increasing knowledge of mathematical anguage by concepts appearing universally across disciptines like differential geometry and abtract algebra. During exercise sessions, students will by practice calculations of introduced mathematical incruses. ZK 3 OIASM Application of Statistical Methods KZ 2 2 OtaSM Application, onparametric methods, contingency tables. Inter-regression and correlation, analysis of variance. OIASM Application, onsama distribution, unparametric methods, contingency tables. Inter-regression and correlation analysis of variance.	01SMS2	Student's seminar in mathematics 2	Z	2	0P+2C	L	V
DTINF Information Theory Matrix Theory Edita Relative & Holis Hobas ZK 3 2P+0C v 01TEMA Matrix Theory Edita Relative & Edita Pelantová Edita Pelantová Edita Pelantová (Gar.) Z 3 2+0 L v 01TEMA Matrix Theory Edita Relative & Edita Pelantová Edita Pelantová Edita Pelantová (Gar.) Z 3 2+0 L v 01TEMA Algebraic Topology Z,ZK 4 04 study of modern mathematical and theoretical physics requires one to acquire an ever increasing knowledge of mathematical apparatus. The main goal of this course is to acquire acculations of introduced mathematical structures. 2,ZK 4 01ZASIG Analysis and Processing of Diagnostic Signals ZK 3 01ASM Application of Statistical Methods KZ 2 2 The course is an application of Statistical Methods KZ 2 2 1 02COX Cocketer Groups Z 2 2 2 1 04 the effectorin orgovis. The edition specific and elistical develop and elistical socincine roleopis and corresponding bilinear forms and the	01TEC	Number Theory Zuzana Masáková, Edita Pelantová Zuzana Masáková Zuzana Masáková	ZK	5	4P+0C		V
DITEMA Matrix Theory Edite Pelantová Edita Pelantová Edita Pelantová Edita Pelantová (Gar.) Z 3 2+0 L v Characteristics of the courses of this group of Study Plan: Code=NMSPAAAV Name=MDP P_AAAN Optional courses 2,ZK 4 A study of modern mathematical and theoretical physics requires one to acquire an ever increasing knowledge of mathematical apparatus. The main goal of this course is to acquare the mathematical language by concepts appearing universally across disciplines like differential geometry and abstract algebra. During excercise sessions, students with basic adjusta and time frequency analysis ZK 3 OIZASIG Analysis and Processing of Diagnostic Signals ZK 3 2 2 2 1 2 <td< td=""><td>01TINF</td><td>Information Theory</td><td>ZK</td><td>3</td><td>2P+0C</td><td></td><td>v</td></td<>	01TINF	Information Theory	ZK	3	2P+0C		v
Characteristics of the courses of this group of Study Plan: Code=NMSPAAAV Name=MDP P_AAAN Optional courses C2ALT Algebraic Topology Z,ZK 4 A study of nodern mathematical and theoretical physics requires one to acquire an ever increasing knowledge of mathematical apparauts. The main goal of this course is to acquire an ever increasing knowledge of mathematical apparauts. The main goal of this course is to acquire situations with back of adjects on topology. Analysis and Processing of Diagnostic Signals ZK 3 Digital signal processing, signal transformations and filtrations, spectral and time-frequency analysis ZK 3 DiASM Application of Statistical Methods KZ 2 The course is an introduction to the theory of Courser groups and their invariant theory, tables, incear regression and correlation, analysis or variance. 2 2 2 OZASM Covereter Groups Z 2 <td>01TEMA</td> <td>Matrix Theory</td> <td>Z</td> <td>3</td> <td>2+0</td> <td>L</td> <td>V</td>	01TEMA	Matrix Theory	Z	3	2+0	L	V
012ASIG Analysis and Processing of Diagnostic Signals ZK 3 0143SM Application of Statistical Methods KZ 2 The course focuses on applications of statistical data analysis to concrete problems including their solutions using statistical software. Namely we will deal with typotheses tests about parameters of normal distribution, nonparametric methods, contingency tables, linear regression and corelation, analysis of variance. Z 2 02COX Coxeter Groups Z 2 2 The course is an introduction to the theory of Coxeter groups and their invariant theory The case of the finite Coxeter groups. As an introduction to the invariant theory of the Coxeter groups, the corresponding bilinear forms and the theory of their classification represent abstriperentization of the reflection groups. The study of affine Weyl groups and related objects forms basic example of infinite Coxeter groups. As an introduction to the invariant theory of the Coxeter groups. The study of affine Weyl internation and applications of database opiects, their properties and relationships together with the accent to logics of decomposition and applications of database opiects. Contary differential equations, numerical methods, Runge-Kutta methods, stability. Partial differential equations, analysis, hyperbo parabolic and elliptic equations, future equations, numerical solution, finite difference encines, order of approximatic stability, corresponder on Malta bystem tor numerica and Maple for analysis of schemes. ZK 4 01DIO Digital Image Processing Iff enertial equations, analysis, hyperoto parabolic and equations, numerical sol	A study of modern mather students with basic methor the mathematical languag	natical and theoretical physics requires one to acquire an ever increasing knowledge of m ds used in algebraic topology, namely elements of category theory, homototopies, homolo e by concepts appearing universally across disciplines like differential geometry and abs	ogical algebra and	cohomolo	e main goal c gy. An import	f this cour ant objecti	se is to acquain ve is to enhance
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01FIMA Financial and Insurance Mathematics ZK 2	intelligent agents need to and its dynamics (includin introduces dynamic decisi for areas inherently involvi uncertainty in your everyd decision-theoretic modellir for a given task/applicatior	reason with uncertain information and limited computational resources. Effective decision g the presence of other intelligent agents), . the agent's goals and preferences . the agen on making under uncertainty and computational methods supporting decision-making. The ng uncertainty. These skills can serve as the foundation for further study in any application ay life. Course objectives: - Learn the basic ideas and techniques underlying design of in ng paradigm Understand state-of-the-art of decision making (DM) Be able to formulate n Be able to understand research papers in the field (main conferences: IJCAI, NeurIPS).	n making requires it's abilities to obs ne course helps to on area you choos telligent rational a decision making	the knowle erve and in develop the se to pursu agents. A sport learning	edge about: . nfluence the one mathemati e and may alloecific empha problem and	the agent' environme cal reasor so help yo asis will be select app	s environment nt. This course ing skills crucia u to analyse the on the propriate method
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01SPEC	Geometrical Aspects of Spectral Theory	ZK	2
1. Motivations. The crist	s of classical physics and the rise of quantum mechanics. Mathematical formulation of quantum theory. Spectral problems in c	classical physics.	2. Elements of
functional analysis. The	discrete and essential spectra. Sobolev spaces. Quadratic forms. Schrödinger operators. 3. Stability of the essential spectrum	n. Weyl's theorem	Bound states.
Variational and perturb	ation methods. 4. The role of the dimension of the Euclidean space. Criticality versus subcriticality. The Hardy inequality. Stabil	lity of matter. 5. G	eometrical
aspects. Glazman's cla	ssification of Euclidean domains and their basic spectral properties. 6. Vibrational systems. The symmetric rearrangement and	d the Faber-Krahn	inequality for
the principal frequency.	7. Quantum waveguides. Elements of differential geometry: curves, surfaces, manifolds. Effective dynamics. 8. Geometrically	induced bound st	ates and
Hardy-type inequalities	in tubes.		
01KOS	Compressed Sensing	ZK	2
The lecture will introduc	e basic concepts of the theory of compressed sensing an area founded in 2006 in the works of D. Donoho, E. Candes, and T.	Tao. This theory	studies the
search for sparse soluti	ons of underdetermined systems of linear equations. Due to the applications of sparse representations in electric engeneering	and signal proces	sing, this theory
was quickly used in ma	ny different fields. After the first survey lecture, we will study the mathematical foundations of the theory. We prove general NP	-completeness of	the search for
sparse solutions of sys	ems of linear equations. We introduce conditions which ensure also existence of more effective solvers and show, that these	are satisfied for ex	cample for
Gaussian random matri	ces. As an effective solution method, we will analyze I1-minimization and Orthogonal Matching Pursuit. We will also study stabili	ity and robustness	s of the obtained
results with respect to t	he corruption of measurements and the optimality of the results.		
02KFA	Quantum Physics	Z,ZK	6
The goal of the lecture	s formulating and developing quantum theory as a physically motivated, but mathematically rigorous theory built upon the an	alysis of bounded	and unbounded
linear operators on sep	arable Hilbert spaces. Previous knowledge of quantum mechanics is an advantage but not a predisposition for the course. The	e pivot point is the	establishing of
the main postulates of t	he theory and deriving their consequences for model systems, as well as a detailed study of the most commonly used observa	ables in quantum	mechanics. The
lecture focuses on the	exactness and proofs of the statements. Some common mistakes resulting from breaking the assumptions of these are also d	iscussed.	
01KVGR1	Quantum Groups 1	Z	2
	riginated in the 80s in the works of professor L. D. Faddeev and the Leningrad school on the inverse scattering method in orc	der to solve integra	
	ations in mathematics and mathematical physics such as the classification of nodes, in the theory of integrable systems and the		
02KVK1	Quantum Circle 1	Z	2
	r Institute on topics of mathematical quantum physics for students and PhD. students.	~	2
02KVK2		Z	2
	Quantum Circle 2	Ζ	2
	r Institute on topics of mathematical quantum physics for students and PhD. students.		0
04MGA1	English for Academic Purposes Speaking Practice - intermediate	Z	2
	Aaster's Degree students at intermediate level of English a chance to improve, develop, and strengthen their vocabulary and strengthen the stren		ourse syllabus
	professional interests and situations of students and choice of topics will be agreed on with tutor. Course is a non-graded asso		
04MGA2	Academic English Writing and Presentation Course - intermadiate	Z	2
	ible free sequel to course 04MGA1, offers Master's degree students at intermediate level of English a chance to develop, imp	-	-
	Syllabus will respond to specific professional needs of participants, but will include also writing and preparing a presentation of		• •
instruction on writing M	aster thesis in English and presenting chosen facts. Course will thus prepare students for presentations at conferences. Course	se is a non-grade	d assessment
course.		,	
01MAL	Mathematical Logic	Z,ZK	4
-	e an object studied by mathematics and the language used to formalize and study mathematics. The goal of the course is to i		
	al logic. 1. Propositions, evaluation, tautologies, axioms, theorems, soundness, completeness, and decidability of Hilbert and G		
	e calculus, terms, formulas, relational structures, satisfiability, truth, tautologies, axioms, theorems, soundness, model constru		
theorem, Skolem and H	erbrand theorems. 4. The first and the second Gödel theorems on incompleteness of Peano arithmetics and undecidability of		
01MMDY	Mathematical Methods in Fluid Dynamics 1	ZK	2
First, the differential eq	ations representing the conservation laws of fluid flow are briefly derived and reviewed. Next, the problems for the resulting e	quations are form	ulated, focusing
on boundary conditions	specification. The reference problem undergoes numerical analysis with emphasis on explaining the weak solution and its rol	le in describing re	al phenomena.
In the second part, imp	ortant problems are introduced, involving fluid flow and other effects (heat transfer, chemical reactions, multiphase nature) and	d an adequate ma	athematical
description is chosen.			
01MBM	Mathematical techniques in biology and medicine	Z,ZK	3
Spatially independent r	nodels; enzyme kinetics; excitable system; reaction-diffusion equations; travelling waves; pattern formation; conditions for Turin	ng instability, the	effect of domain
size; the concept of sta	ility in PDEs, spectrum of a linear operator, semigroups.		
01MKP	Finite Element Method		
		ZK	3
Mathematical propertie	o the mathematical theory of the finite element method numerically solving boundary-value and initial-boundary-value problem		-
	b the mathematical theory of the finite element method numerically solving boundary-value and initial-boundary-value problem s of the method are explained. The approximation error estimates are derived.		-
18MEMC	s of the method are explained. The approximation error estimates are derived.	is for partial differe	ential equations.
18MEMC This courseis devoted t	s of the method are explained. The approximation error estimates are derived. Monte Carlo Method		-
This courseis devoted t	s of the method are explained. The approximation error estimates are derived. Monte Carlo Method	s for partial differe	ential equations.
This courseis devoted t 01MRMMI	s of the method are explained. The approximation error estimates are derived. Monte Carlo Method the numerical method Monte Carlo and to its selected applications. Methods for Sparse Matrices	S for partial difference Z,ZK	ential equations. 4 2
This courseis devoted t 01MRMMI The course is aimed at	s of the method are explained. The approximation error estimates are derived. Monte Carlo Method to the numerical method Monte Carlo and to its selected applications. Methods for Sparse Matrices utilization of sparse matrices in direct methods for solution of large systems of linear algebraic equations. The course will cove	Z,ZK	ential equations. 4 2 ion theory for
This course is devoted t 01MRMMI The course is aimed at symmetric and positive	s of the method are explained. The approximation error estimates are derived. Monte Carlo Method the numerical method Monte Carlo and to its selected applications. Methods for Sparse Matrices	Z,ZK	ential equations. 4 2 ion theory for
This course is devoted to 01MRMMI The course is aimed at symmetric and positive issues will be covered.	s of the method are explained. The approximation error estimates are derived. Monte Carlo Method b the numerical method Monte Carlo and to its selected applications. Methods for Sparse Matrices utilization of sparse matrices in direct methods for solution of large systems of linear algebraic equations. The course will cove definite matrices. Theoretic results will be further applied for solution of more general systems. Main features of the methods are applied for solution of more general systems.	Z,ZK	4 2 ion theory for lementation
This course is devoted to 01MRMMI The course is aimed at symmetric and positive issues will be covered. 01NSN	s of the method are explained. The approximation error estimates are derived. Monte Carlo Method to the numerical method Monte Carlo and to its selected applications. Methods for Sparse Matrices utilization of sparse matrices in direct methods for solution of large systems of linear algebraic equations. The course will cove definite matrices. Theoretic results will be further applied for solution of more general systems. Main features of the methods and Neural Networks, Machine Learning, and Randomness	Z,ZK	ential equations. 4 2 ion theory for
This course is devoted to 01MRMMI The course is aimed at symmetric and positive issues will be covered. 01NSN Keywords: Neural netw	s of the method are explained. The approximation error estimates are derived. Monte Carlo Method to the numerical method Monte Carlo and to its selected applications. Methods for Sparse Matrices utilization of sparse matrices in direct methods for solution of large systems of linear algebraic equations. The course will cove definite matrices. Theoretic results will be further applied for solution of more general systems. Main features of the methods are methods are separation, functional approximation, supervised learning	KZ KZ er the decomposi and common imp Z,ZK	ential equations. 4 2 ion theory for lementation 2
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01PSM2	Problem Seminar in Mathematical Analysis 2	Z	2
This course is a semina	ar in advanced mathematical analysis and its applications. Seminar talks will be delivered by students, department staff, and ir	vited quests. The	re are no exams
but students will be ass	igned by some homework and they will give at least one talk per semester. The seminar is held in English and attendance is i	mandatory.	
02RMMF	Solvable Models of Mathematical Physics	Z	2
Elementary methods fo	r solving nonlinear differential equations occuring in mathematical physics are explained.		1
01SUP	Start-up Project	KZ	2
01SVK	Student's Scientific Conference	Z	1
This is the active partic	ipation of the student in one of the approved student conferences. The list of such conferences is defined by the course guar	intor.	1
01SMS1	Student's seminar in mathematics 1	Z	2
01SMS2	Student's seminar in mathematics 2	Z	2
01TEC	Number Theory	ZK	5
1. Algebraic and transc	endental numbers 2. Algebraic number fields, field isomorphisms 3. Rational approximations, continued fractions 4. Diophanti	c equations, Pell'	s equation 5.
Rings of integers in alg	ebraic number fields and divisibility 6. Number representation in non-integer bases, finite and periodic expansions		
01TINF	Information Theory	ZK	3
Information theory expl	ores the fundamental limits of the representation and transmission of information. We will focus on the definition and implication	ons of (informatio	n) entropy, the
source coding theorem	, and the channel coding theorem. These concepts provide a vital background for researchers in the areas of data compression	on, signal process	sing, controls,
and pattern recognition			
01TEMA	Matrix Theory	Z	3
The subject deals main	ly with: 1) similarity of matrices and canonical forms of matrices 2) Perron-Frobenius theory and its applications 3) tensor pro-	duct 4) Hermitian	and positive
semidefinite matrices			

List of courses of this pass:

Code	Name of the course	Completion	Credits
01ASM	Application of Statistical Methods	KZ	2
The course focuse	ss on applications of selected methods of statistical data analysis to concrete problems including their solutions using statistical softw	are. Namely we wi	II deal with:
hypoth	eses tests about parameters of normal distribution, nonparametric methods, contingency tables, linear regression and correlation, ar	alysis of variance.	
01ASY	Asymptotical Methods	Z,ZK	3
Examples. Additi	on parts of mathematical analysis (generalized Lebesgue integral, parametric integrals.) Asymptotic relations a expansions - properti	es; algebraical and	analytical
	operations. Applied asymptotics of sequences and sums; integrals of Laplace and Fourier type.		
01DISE	Diploma Seminar	Z	1
In the first part of t	he seminar, students familiarize themselves with the general principles of publishing and presenting scientific work and the formal required	uirements for diplo	ma projects
at the faculty. The	second part is designed as a practical training for the defence of the diploma project. The students give oral presentations of the curre	nt state of the rese	arch results
achieved during t	he work on their projects. Each presentation is followed by a discussion on scientific matters as well as on the possibilities of improvi	ng the students per	formance.
01DIZO	Digital Image Processing	ZK	4
image sampling ar	d quantization, Shannon theorem, aliasing basic image operations, histogram, contrast stretching, noise removal, image sharpening l	inear filtering in the	spatial and
frequency domains	s, convolution, Fourier transform edge detection, corner detection feature detection image degradations and their modelling, inverse a	and Wiener filtering	, restoration
	of motion-blurred and out-of-focus blurred images image segmentation mathematical morphology image registration and mate	ching	
01DPAA1	Master Thesis 1	Z	10
The diploma project	t is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the pro	ect supervisor duri	ng common
	regular meetings and discussions.		
01DPAA2	Master Thesis 2	Z	20
The diploma project	t is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the pro	ect supervisor duri	ng common
	regular meetings and discussions.		
01DYNR1	Dynamic Decision Making 1	Z,ZK	3
Design, control a	nd analysis of intelligent agents (or systems) that behave appropriately in various circumstances are highly demanded (artificial intelli	gence and machin	e learning,
data mining, financ	ial modelling, natural language processing, bioinformatics, web search and information retrieval, algorithm design, system design, netv	work analysis, and	more). Such
intelligent agents	need to reason with uncertain information and limited computational resources. Effective decision making requires the knowledge ab	out: . the agent's er	nvironment
•	(including the presence of other intelligent agents), . the agent's goals and preferences . the agent's abilities to observe and influence		
	c decision making under uncertainty and computational methods supporting decision-making. The course helps to develop the mathe	•	
	y involving uncertainty. These skills can serve as the foundation for further study in any application area you choose to pursue and ma		
	your everyday life. Course objectives: - Learn the basic ideas and techniques underlying design of intelligent rational agents. A specification of the set		
	modelling paradigm Understand state-of-the-art of decision making (DM) Be able to formulate decision making or learning problem		
ior a given task/ap	plication Be able to understand research papers in the field (main conferences: IJCAI, NeurIPS, AAMAS, ICAART, ICM; main journ - Try out some ideas of your own.	ais: AI, JAIR, JAAN	IAS, IJAR).
		7 71/	_
01FAN3	Functional Analysis 3	Z,ZK	5
	functional analysis needed for theory of representations of Lie groups and quantum theory. Compact operators, their ideals, unbounde elfadjoint extension of symmetric operators, Stones theorem, quadratic forms and Bochner integral. The basics of Banach algebras a	<i>,</i> ,	nors, meory
		, J	
01FIMA	Financial and Insurance Mathematics	ZK	2
	This course is an introduction to the problems of life and non-life insurance and financial mathematics.	71/	
01KOAL	Commutative Algebra	ZK	3
	promorphisms, prime and maximal ideals. 2. Rings of polynomials, symmetric polynomials, irreducibility. 3. Gröbner bases. 4. Polyno		
lactorization of p	olynomials. 5. Hilbert's Nullstellensatz, ideals and manifolds, Krull dimension. 6. Fields, extensions, finite fields. 7. Introduction to Gala	ns meory, Galois e	klensions,
	group and correspondence.		

01KOS	Compressed Sensing	ZK	2	
	ntroduce basic concepts of the theory of compressed sensing an area founded in 2006 in the works of D. Donoho, E. Candes, and T.			
	plutions of underdetermined systems of linear equations. Due to the applications of sparse representations in electric engeneering and		-	
	n many different fields. After the first survey lecture, we will study the mathematical foundations of the theory. We prove general NP-co	-		
	of systems of linear equations. We introduce conditions which ensure also existence of more effective solvers and show, that these a natrices. As an effective solution method, we will analyze 11-minimization and Orthogonal Matching Pursuit. We will also study stability a		· ·	
Caussian randomin	results with respect to the corruption of measurements and the optimality of the results.			
01KVGR1	Quantum Groups 1	Z	2	
	was originated in the 80s in the works of professor L. D. Faddeev and the Leningrad school on the inverse scattering method in orde	- 1		
They have	many applications in mathematics and mathematical physics such as the classification of nodes, in the theory of integrable systems	and the string theo	ory.	
01MAL	Mathematical Logic	Z,ZK	4	
-	e time an object studied by mathematics and the language used to formalize and study mathematics. The goal of the course is to intr			
	atical logic. 1. Propositions, evaluation, tautologies, axioms, theorems, soundness, completeness, and decidability of Hilbert and Gent			
	edicate calculus, terms, formulas, relational structures, satisfiability, truth, tautologies, axioms, theorems, soundness, model construct olem and Herbrand theorems. 4.The first and the second Gödel theorems on incompleteness of Peano arithmetics and undecidability			
01MBM	Mathematical techniques in biology and medicine	Z.ZK	3	
-	ent models; enzyme kinetics; excitable system; reaction-diffusion equations; travelling waves; pattern formation; conditions for Turing i	,	-	
	size; the concept of stability in PDEs, spectrum of a linear operator, semigroups.	, ,		
01MKP	Finite Element Method	ZK	3	
	ed to the mathematical theory of the finite element method numerically solving boundary-value and initial-boundary-value problems fc	1	l equations.	
	Mathematical properties of the method are explained. The approximation error estimates are derived.			
01MMDY	Mathematical Methods in Fluid Dynamics 1	ZK	2	
	l equations representing the conservation laws of fluid flow are briefly derived and reviewed. Next, the problems for the resulting equa		-	
	tions specification. The reference problem undergoes numerical analysis with emphasis on explaining the weak solution and its role in	• ·		
in the second pa	rt, important problems are introduced, involving fluid flow and other effects (heat transfer, chemical reactions, multiphase nature) and description is chosen.	an adequate matr	iematicai	
01MRMMI	Methods for Sparse Matrices	KZ	2	
	ed at utilization of sparse matrices in direct methods for solution of large systems of linear algebraic equations. The course will cover			
	positive definite matrices. Theoretic results will be further applied for solution of more general systems. Main features of the methods a	•		
	issues will be covered.			
01NAH	Theory of Random Processes	ZK	3	
The course is devot	ed in part to the basic notions of the general theory of random processes and partially to the theory of stationary processes and seque	nces both weakly a	and strongly	
	stationary ones.			
01NELO	Nonlinear Optimization	ZK	4	
Nonlinear optimizat	ion problems find their application in may areas of applied mathematics. The lecture covers the basics of mathematical programming th optimization and basic methods for unconstrained and constrained optimization. The lecture is supplemented by illustrative examples		s on convex	
	optimization and basic methods for unconstrained and constrained optimization. The fecture is supplemented by individuate example	npica.		
	Neural Networks, Machine Learning, and Pandomness	-	2	
01NSN	Neural Networks, Machine Learning, and Randomness	Z,ZK	2	
	Keywords: Neural networks, data separation, functional approximation, supervised learning	Z,ZK		
01PDE		Z,ZK Z,ZK	4	
01PDE 1. Sobolev spaces	Keywords: Neural networks, data separation, functional approximation, supervised learning Modern theory of partial differential equations	Z,ZK Z,ZK tance, derivation o	4 f the weak	
01PDE 1. Sobolev spaces formulation). 6. E	Keywords: Neural networks, data separation, functional approximation, supervised learning Modern theory of partial differential equations . 2. Definition, completeness, examples. 3. Continuous and compact embedding theorems. 4. Trace theorem. 5. Weak solution (impor liptic PDE of Second Order. 7. Existence and uniqueness of weak solutions (Lax-Milgram theorem). 8. Regularity of weak solutions. variations, Poincaré inequality. 10. Maximum principle for classical and weak solutions.	Z,ZK Z,ZK tance, derivation o 9. Relation to the c	4 f the weak alculus of	
01PDE 1. Sobolev spaces formulation). 6. El 01PNL	Keywords: Neural networks, data separation, functional approximation, supervised learning Modern theory of partial differential equations . 2. Definition, completeness, examples. 3. Continuous and compact embedding theorems. 4. Trace theorem. 5. Weak solution (impor liptic PDE of Second Order. 7. Existence and uniqueness of weak solutions (Lax-Milgram theorem). 8. Regularity of weak solutions. variations, Poincaré inequality. 10. Maximum principle for classical and weak solutions. Advanced Methods of Numerical Linear Algebra	Z,ZK Z,ZK tance, derivation o 9. Relation to the c ZK	4 f the weak alculus of 2	
01PDE 1. Sobolev spaces formulation). 6. El 01PNL Representation of r	Keywords: Neural networks, data separation, functional approximation, supervised learning Modern theory of partial differential equations . 2. Definition, completeness, examples. 3. Continuous and compact embedding theorems. 4. Trace theorem. 5. Weak solution (impor liptic PDE of Second Order. 7. Existence and uniqueness of weak solutions (Lax-Milgram theorem). 8. Regularity of weak solutions. Variations, Poincaré inequality. 10. Maximum principle for classical and weak solutions. Advanced Methods of Numerical Linear Algebra eal numbers in computers, behaviour of rounding errors during numerical computations, sensitivity of a problem, numerical stability of	Z,ZK Z,ZK tance, derivation o 9. Relation to the c ZK f an algorithm. We	4 f the weak alculus of 2 will analyse	
01PDE 1. Sobolev spaces formulation). 6. El 01PNL Representation of re- sensitivity of the ele	Keywords: Neural networks, data separation, functional approximation, supervised learning Modern theory of partial differential equations . 2. Definition, completeness, examples. 3. Continuous and compact embedding theorems. 4. Trace theorem. 5. Weak solution (impor liptic PDE of Second Order. 7. Existence and uniqueness of weak solutions (Lax-Milgram theorem). 8. Regularity of weak solutions. Variations, Poincaré inequality. 10. Maximum principle for classical and weak solutions. Advanced Methods of Numerical Linear Algebra eal numbers in computers, behaviour of rounding errors during numerical computations, sensitivity of a problem, numerical stability of genvalues of a given matrix and sensitivity of roots of systems of linear algebraic equations. Then, the backward analysis of these pro-	Z,ZK Z,ZK tance, derivation o 9. Relation to the c ZK f an algorithm. We oblems will be perfo	4 f the weak alculus of 2 will analyse ormed. The	
01PDE 1. Sobolev spaces formulation). 6. El 01PNL Representation of re- sensitivity of the ele	Keywords: Neural networks, data separation, functional approximation, supervised learning Modern theory of partial differential equations . 2. Definition, completeness, examples. 3. Continuous and compact embedding theorems. 4. Trace theorem. 5. Weak solution (impor liptic PDE of Second Order. 7. Existence and uniqueness of weak solutions (Lax-Milgram theorem). 8. Regularity of weak solutions. variations, Poincaré inequality. 10. Maximum principle for classical and weak solutions. Advanced Methods of Numerical Linear Algebra eal numbers in computers, behaviour of rounding errors during numerical computations, sensitivity of a problem, numerical stability of genvalues of a given matrix and sensitivity of roots of systems of linear algebraic equations. Then, the backward analysis of these procurse is devoted to the methods of QR-decomposition, least squares problem, and to several modern Krylov subspace methods for the	Z,ZK Z,ZK tance, derivation o 9. Relation to the c ZK f an algorithm. We oblems will be perfo	4 f the weak alculus of 2 will analyse ormed. The	
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01TG	Graph Theory ph theory. 2. Edge and vertex connectivity (Menger Theorem). 3. Bipartite graphs. 4. Trees and forests. 5. Spanning trees (Matrix	-Tree Theorem) 6	5 Fuler tours
	7. Maximal and perfect matching. 8. Edge coloring. 9. Flows in networks. 10. Vertex coloring. 11. Plannar graphs (Kuratowski theo		
	graphs. 12. Spectrum of the adjacency matrix. 13. Extremal graph theory.		0
01TINF	Information Theory	ZK	3
nformation theory ex	plores the fundamental limits of the representation and transmission of information. We will focus on the definition and implication	ns of (information)	entropy, the
source coding theore	m, and the channel coding theorem. These concepts provide a vital background for researchers in the areas of data compressio	n, signal processir	ng, controls
	and pattern recognition.		
01TNM	Random Matrix Theory	ZK	2
	rices appeared first in 60's in the 20th century in connection with statistical physics and the theory of nucleis of atoms of heavy mo genvalues of symmetric random matrices. In the 21st century the results of theory of random matrices were applied in theoretical of		
	for design of random matrices. In the 2 ist century the results of theory of random matrices were applied in theoretical to	computer science a	
01TR1	Theory of representations 1	ZK	2
orner	Basic knowledge about representations of groups, with emphasize given to finite groups.		-
01TRE2	Representation theory 2	ZK	5
	ntations of compact groups, Schur's lemma, orthogonality relations, Casimir operators. 2. Lie groups and algebras, matrix groups	1	-
xponential map, grou	p SU(n) and their representations. 3. Decomposition of representations, Clebsh-Gordan coeficients. 4. Gelfand-Tsetlin bases, Ve	rma bases 5. Rep	presentation
	functions. 6. Classification of irreducible representations of semisimple Lie algebras, Cartan subalgebra, roots, weights, lattices, V	-	Classical a
	tional simple Lie algebras, Dynkin diagrams. 8. Realizations of Lie algebras, Weyl algebras. 9. Representations of Lie superalger	1	
01UMIN	Probabilistic Models of Artificial Intelligence	KZ	2
The course is devote	d to the survey of methods used for uncertainty processing in the field of artificial inteligence. The main attention is paid to so-ca particularly to Bayesian networks.	lied graphical Mari	kov models
01URG	Introduction to Riemannian geometry	ZK	2
1	ded for an advanced undergraduate having possibly (but not necessarily) already taken a basic course on topological and differe	1	1
	metric meaning of curvature and its intimate relationship to topology, the student will learn the basic apparatus of Riemannian geo		
of modern parts of	mathematics and mathematical physics. Possible extension of this lecture is the geometric analysis of partial differential equation	ns on Riemannian	manifolds.
01UTS	Introduction to the Theory of Semigroups	ZK	3
It is known that a s	ystem of linear ordinary differential equations can be solved by virtue of the matrix exponential. However, the extension to partial	differential equati	ons is not
•	ample in the case of heat equation the matrix is replaced by Laplace operator which is not bounded and the series for the exponen		-
	equation exist in general only for positive times and hence the solution operator can be at best a semigroup. The aim of the cours	-	
	hese types of problems and extend the concept of stability from ordinary differential equations, which is again in relation to spect		-
01VAM	Variational Methods to the methods of classical variational calculus - functional extrema by Euler equations, second functional derivative, convexity or r	ZK	3
	investigation of quadratic functional, generalized solution, Sobolev spaces and variational problem for elliptic PDE's.	nonotonicity. Furth	er, it contai
01VUAA1	Research Project 1	Z	6
1	s based on a topic approved by the administrators of the programme and by the head of the de-partment. The student is guided l	-	-
	common regular meetings and discussions	.,	
01VUAA2	Research Project 2	KZ	8
he research project i	s based on a topic approved by the administrators of the programme and by the head of the de-partment. The student is guided l	by the project supe	rvisor duri
	common regular meetings and discussions.		-
01ZASIG	Analysis and Processing of Diagnostic Signals	ZK	3
	Digital signal processing, signal transformations and filtrations, spectral and time-frequency analysis		1
02ALT	Algebraic Topology	Z,ZK	4
	thematical and theoretical physics requires one to acquire an ever increasing knowledge of mathematical apparautus. The main g thods used in algebraic topology, namely elements of category theory, homototopies, homological algebra and cohomology. An in		
	juage by concepts appearing universally across disciplines like differential geometry and abstract algebra. During excercise sess		
	calculations of introduced mathematical structures.	,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
02COX	Coxeter Groups	Z	2
The course is an intro	duction to the theory of Coxeter groups and their invariant theory. The case of the finite Coxeter groups - the reflection groups ar	nd their properties	are studied
-	I chamber and length are defined. General theory of the Coxeter groups, the corresponding bilinear forms and the theory of their of	-	
generalization of the	reflection groups. The study of affine Weyl groups and related objects forms basic example of infinite Coxeter groups. As an intro	duction to the inva	riant theor
	the MacDonald identity and the Weyl identity are presented.		
02KFA	Quantum Physics		6
•	is formulating and developing quantum theory as a physically motivated, but mathematically rigorous theory built upon the analy parable Hilbert spaces. Previous knowledge of quantum mechanics is an advantage but not a predisposition for the course. The parable Hilbert spaces are as a space of the space		
	the theory and deriving their consequences for model systems, as well as a detailed study of the most commonly used observab		0
-	uses on the exactness and proofs of the statements. Some common mistakes resulting from breaking the assumptions of these	-	
02KVK1	Quantum Circle 1	Z	2
	Seminars of the Doppler Institute on topics of mathematical quantum physics for students and PhD. students.	1	1
021(11(1	Quantum Circle 2	Z	2
02KVK2			
02KVK2	Seminars of the Doppler Institute on topics of mathematical quantum physics for students and PhD. students.		
	Seminars of the Doppler Institute on topics of mathematical quantum physics for students and PhD. students. Solvable Models of Mathematical Physics	Z	2
02KVK2	Solvable Models of Mathematical Physics Elementary methods for solving nonlinear differential equations occuring in mathematical physics are explained.		
02KVK2 02RMMF 04MGA1	Solvable Models of Mathematical Physics Elementary methods for solving nonlinear differential equations occuring in mathematical physics are explained. English for Academic Purposes Speaking Practice - intermediate	Z	2
02KVK2 02RMMF 04MGA1 Optional course offers	Solvable Models of Mathematical Physics Elementary methods for solving nonlinear differential equations occuring in mathematical physics are explained. English for Academic Purposes Speaking Practice - intermediate s Master's Degree students at intermediate level of English a chance to improve, develop, and strengthen their vocabulary and s	Z peaking skills. Cou	2 Irse syllabu
02KVK2 02RMMF 04MGA1 Optional course offers will respond to	Solvable Models of Mathematical Physics Elementary methods for solving nonlinear differential equations occuring in mathematical physics are explained. English for Academic Purposes Speaking Practice - intermediate Master's Degree students at intermediate level of English a chance to improve, develop, and strengthen their vocabulary and s p specific professional interests and situations of students and choice of topics will be agreed on with tutor. Course is a non-grade	Z peaking skills. Cou	2 Irse syllabu Irse.
02KVK2 02RMMF 04MGA1 Optional course offers will respond to 04MGA2	Solvable Models of Mathematical Physics Elementary methods for solving nonlinear differential equations occuring in mathematical physics are explained. English for Academic Purposes Speaking Practice - intermediate Master's Degree students at intermediate level of English a chance to improve, develop, and strengthen their vocabulary and so pspecific professional interests and situations of students and choice of topics will be agreed on with tutor. Course is a non-grade Academic English Writing and Presentation Course - intermadiate	Z peaking skills. Cou ed assessment cou	2 Irse syllabu Irse. 2
02KVK2 02RMMF 04MGA1 0ptional course offers will respond to 04MGA2 0ptional course, a pos	Solvable Models of Mathematical Physics Elementary methods for solving nonlinear differential equations occuring in mathematical physics are explained. English for Academic Purposes Speaking Practice - intermediate Master's Degree students at intermediate level of English a chance to improve, develop, and strengthen their vocabulary and so pspecific professional interests and situations of students and choice of topics will be agreed on with tutor. Course is a non-grade Academic English Writing and Presentation Course - intermadiate sible free sequel to course 04MGA1, offers Master's degree students at intermediate level of English a chance to develop, impro-	Z peaking skills. Couled assessment cou	2 Irse syllabu Irse. 2 n their writin
02KVK2 02RMMF 04MGA1 Optional course offers will respond to 04MGA2 Optional course, a pos and presentation skills	Solvable Models of Mathematical Physics Elementary methods for solving nonlinear differential equations occuring in mathematical physics are explained. English for Academic Purposes Speaking Practice - intermediate Master's Degree students at intermediate level of English a chance to improve, develop, and strengthen their vocabulary and so pspecific professional interests and situations of students and choice of topics will be agreed on with tutor. Course is a non-grade Academic English Writing and Presentation Course - intermadiate	Z peaking skills. Couled assessment couled assessment couled assessment couled assessment couled as the strengther own research top	2 urse syllabu urse. 2 n their writin

12DRP	Differential Equations on Computer	Z,ZK	5
Ordinary differential equations, analytical methods; Ordinary differential equations, numerical methods, Runge-Kutta methods, stability; Partial differential equations, analysis, hyperbolik,			
parabolic and elliptic equations, posedness of differential equaitons; Partial differential equations, numerical solution, finite difference methods, difference schemes, order of approximation,			
stability, convergence, modified equation, diffusion, dispersion; Conservation laws and their numerical solution, shallow water equations, Euler equations, Lagrangian methods, ALE			
methods; Practical computation in Matlab system for numerics and Maple for analysis of schemes.			
18DDS	Database System Decomposition	ZK	4
The lectures are oriented to basic terms, database objects, their properties and relationships together with the accent to logics of decomposition and applications of database operations.			
18MEMC	Monte Carlo Method	Z,ZK	4
This courseis devoted to the numerical method Monte Carlo and to its selected applications.			
1800P	Object Oriented Programming	Z	2
This course consists of the contributions of students concerning given topics concerned on technologies uded in program development.			

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