

Subdivided Module Catalogue for the Subject

Mathematics

as a Master's with 1 major with the degree "Master of Science" (120 ECTS credits)

Examination regulations version: 2010 Responsible: Institute of Mathematics



Course of Studies - Contents and Objectives

The mathematics Master programme is offered by the Department of Mathematics, with a total of currently (SS 2010) 9 chairs.

The Masters study programme in mathematics is intended to provide the students with the following abilities.

- capacity of abstraction,
- exactness in analytic reasoning,
- excellent capacity to realize the structure of complex interconnections,
- sound qualification in applying mathematical methods to specific problems,
- insight into the intrinsic mathematical interdependence of different mathematical fields, as well as into interdisciplinary connections,
- high stamina in dealing with difficult problems,
- high competence in problem solving,
- ability to carry our independent scientific work on a high level,
- ability to cooperate as responsible mathematician within an interdisciplinary team of mathematicians, computer scientists, natural scientists, engineers, or specialists in economical sciences and entrepreneurship,
- insight into and overview over current research in at least one field of contemporary mathematics,
- qualification for meeting the standards of a Ph.D. study in mathematics (if applicable).

For the Master thesis the student should work on a thematic and temporally closely limited frame in order to carry out independently a mathematical task, using well-known procedures and scientific criteria, or modifying them if necessary.

The Masters exam should ascertain whether the candidate overlooks the context of the basics in mathematics and possesses the ability to use the corresponding scientific methods, achieving in this way a further professional and/or scientific qualification.



Abbreviations used

Course types: $\mathbf{E} = \text{field trip}$, $\mathbf{K} = \text{colloquium}$, $\mathbf{O} = \text{conversatorium}$, $\mathbf{P} = \text{placement/lab course}$, $\mathbf{R} = \text{project}$, $\mathbf{S} = \text{seminar}$, $\mathbf{T} = \text{tutorial}$, $\ddot{\mathbf{U}} = \text{exercise}$, $\mathbf{V} = \text{lecture}$

Term: **SS** = summer semester, **WS** = winter semester

Methods of grading: **NUM** = numerical grade, **B/NB** = (not) successfully completed

Regulations: **(L)ASPO** = general academic and examination regulations (for teaching-degree programmes), **FSB** = subject-specific provisions, **SFB** = list of modules

Other: A = thesis, LV = course(s), PL = assessment(s), TN = participants, VL = prerequisite(s)

Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

In accordance with

the general regulations governing the degree subject described in this module catalogue:

ASP02009

associated official publications (FSB (subject-specific provisions)/SFB (list of modules)):

05-Jul-2010 (2010-35)

14-Jul-2011 (2011-69)

This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.



The subject is divided into

Abbreviation	Module title	ECTS credits	Method of grading	page
Mathematics		Į.	<u> </u>	
Advanced Programme (15	ECTS credits)			
10-M=ARTH-102-m01	Introduction to Control Theory	10	NUM	74
10-M=AAAN-102-m01	Applied Analysis	10	NUM	54
10-M=AALG-102-m01	Topics in Algebra	10	NUM	56
10-M=ADGM-102-m01	Differential Geometry	10	NUM	58
10-M=AFTH-102-m01	Complex Analysis	10	NUM	60
10-M=AGMS-102-m01	Geometric Structures	10	NUM	62
10-M=AIST-102-m01	Industrial Statistics 1	10	NUM	66
10-M=ALTH-102-m01	Lie Theory	10	NUM	68
10-M=ANGG-102-m01	Numeric of large Systems of Equations	10	NUM	70
10-M=AOPT-102-m01	Basics of Optimization	10	NUM	72
10-M=ASMR-102-m01	Stochastic Models for Risk Analysis	10	NUM	76
10-M=ASTP-102-m01	Stochastical Processes	10	NUM	78
10-M=ATOP-102-m01	Topology	10	NUM	80
10-M=AVSM-102-m01	Insurance Mathematics	10	NUM	82
10-M=AZRA-102-m01	Time Series Analysis 1	10	NUM	84
10-M=AZTH-102-m01	Number Theory	10	NUM	86
10-M=AGPC-102-mo1 Giovanni-Prodi Lecture (Master)		5	NUM	64
Specialisation (15 ECTS c	redits)			
10-M=VATP-102-m01	Algebraic Topology	10	NUM	115
10-M=VFNM-102-m01	Special Topics in Financial Mathematics	10	NUM	121
10-M=VGDS-102-m01	Groups and their Representations	10	NUM	123
10-M=VGEM-102-m01	Geometrical Mechanics	10	NUM	125
10-M=VIST-102-m01	Industrial Statistics 2	10	NUM	131
10-M=VKAR-102-m01	Field Arithmetics	10	NUM	133
10-M=VNPE-102-m01	Numeric of Partial Differential Equations	10	NUM	143
10-M=VOPT-102-m01	Selected Topics in Optimization	10	NUM	145
10-M=VSTA-102-m01	Statistical Analysis	10	NUM	151
10-M=VVSM-102-m01	Insurance Mathematics 2	10	NUM	153
10-M=VZRA-102-m01	Time Series Analysis 2	10	NUM	157
10-M=VDIM-102-m01	Discrete Mathematic	5	NUM	117
10-M=VDSR-102-m01	Dynamical Systems and Control	5	NUM	119
10-M=VGEO-102-m01	Aspects of Geometry	5	NUM	127
10-M=VGRM-102-m01	Basics in Mathematics	5	NUM	129
10-M=VMBV-102-m01	Mathematical Imaging	5	NUM	135
10-M=VMPH-102-m01	Selected Topics in Mathematical Physics	5	NUM	137
10-M=VMTH-102-m01	Modul Theory	5	NUM	139
10-M=VNAN-102-m01	Non-Linear Analysis	5	NUM	141
10-M=VOST-102-m01	Optimal Control	5	NUM	147
10-M=VQKC-102-m01	Quantum Control and Quantum Computing	5	NUM	149
10-M=VVSY-102-m01	Networked Systems	5	NUM	155



Workshops and Seminars	(10 ECTS credits)			
10-M=GALG-102-m01	Study Group Algebra	10	NUM	91
10-M=GDIM-102-m01	Study Group Discrete Mathematics	10	NUM	92
10-M=GDSR-102-m01	Study Group Dynamical Systems and Control	10	NUM	93
10-M=GFTH-102-m01	10-M=GFTH-102-m01 Study Group Complex Analysis			
10-M=GGMT-102-m01	Study Group Geometry and Topology	10	NUM	95
10-M=GMKX-102-m01	Study Group Mathematics in its Context	10	NUM	96
10-M=GMUI-102-m01	Study Group Measure and Integral	10	NUM	97
10-M=GNMA-102-m01	Study Group Numerical Mathematics and Applied Analysis	10	NUM	98
10-M=GROK-102-m01	Study Group Robotic, Optimization and Control Theory	10	NUM	99
10-M=GSTA-102-m01	Study Group Statistics	10	NUM	100
10-M=GZRA-102-m01	Study Group Time Series Analysis	10	NUM	101
10-M=GZTH-102-m01	Study Group Number Theory	10	NUM	102
10-M=SADG-102-m01	Seminar in Applied Differential Geometry	5	NUM	104
10-M=SALG-102-m01	Seminar in Algebra	5	NUM	105
10-M=SDSR-102-m01	Seminar in Dynamical Systems and Control	5	NUM	106
10-M=SFTH-102-m01	Seminar in Complex Analysis	5	NUM	107
10-M=SFVM-102-m01	Seminar Financial and Insurance Mathematics	5	NUM	108
10-M=SGMT-102-m01	Seminar in Geometry and Topology	5	NUM	109
10-M=SGPC-102-m01	Giovanni-Prodi Seminar (Master)	5	NUM	110
10-M=SIDZ-102-m01	Interdisciplinary Seminar	5	NUM	111
10-M=SNMA-102-m01	Seminar in Numerical Mathematics and Applied Analysis	5	NUM	112
10-M=SOPT-102-m01	Seminar in Optimization	5	NUM	113
10-M=SSTA-102-m01	10-M=SSTA-102-m01 Seminar in Statistics		NUM	114
Learning by Teaching	lits; students may choose whether or not to take modules in this	s area		
10-M=ELT1-102-m01	Learning by teaching Mathematics 1	5	NUM	88
10-M=ELT2-102-m01	Learning by Teaching 2	5	NUM	89
Thesis (30 ECTS credits)				
10-M=MAAR-102-m01	Master Thesis Mathematics	30	NUM	103
Students may choose whether	d Subject and/or Application-oriented Work Placement er or not to take modules in this area. Students may choose to cojects and/or an application-oriented work placement worth a to	omplete mo tal of no mo	odules from the ore than 30 EC	e speci- TS cre-
Application-oriented Subje	ct Chemistry			,
08 TCM2 102 m21				
08-TCM2-102-m01	Computational Chemistry	5	NUM	12
08-TCM2-102-m01 08-TCM1-102-m01	Computational Chemistry Theoretical Chemistry	5	NUM NUM	12 11
		 		-
08-TCM1-102-m01	Theoretical Chemistry	5	NUM	11
08-TCM1-102-m01 08-MCM3-102-m01	Theoretical Chemistry Principles of drug design	5	NUM NUM	11 8
08-TCM1-102-m01 08-MCM3-102-m01 08-TCM3-102-m01	Theoretical Chemistry Principles of drug design Programming in Theoretical Chemistry Theoretical Chemistry - Project work	5 5 5	NUM NUM	11 8 13
08-TCM1-102-m01 08-MCM3-102-m01 08-TCM3-102-m01	Theoretical Chemistry Principles of drug design Programming in Theoretical Chemistry Theoretical Chemistry - Project work	5 5 5	NUM NUM	11 8 13
08-TCM1-102-m01 08-MCM3-102-m01 08-TCM3-102-m01 08-TCAP-102-m01 Application-oriented Subje	Theoretical Chemistry Principles of drug design Programming in Theoretical Chemistry Theoretical Chemistry - Project work ct Computer Science	5 5 5 10	NUM NUM NUM B/NB	11 8 13 9
08-TCM1-102-m01 08-MCM3-102-m01 08-TCM3-102-m01 08-TCAP-102-m01 Application-oriented Subje	Theoretical Chemistry Principles of drug design Programming in Theoretical Chemistry Theoretical Chemistry - Project work Ct Computer Science Algorithmic Graph Theory	5 5 5 10	NUM NUM NUM B/NB	11 8 13 9
08-TCM1-102-m01 08-MCM3-102-m01 08-TCM3-102-m01 08-TCAP-102-m01 Application-oriented Subje 10-I-GT-102-m01 10-I-DB-102-m01	Theoretical Chemistry Principles of drug design Programming in Theoretical Chemistry Theoretical Chemistry - Project work ct Computer Science Algorithmic Graph Theory Databases	5 5 5 10	NUM NUM NUM B/NB NUM	11 8 13 9 46 43
08-TCM1-102-m01 08-MCM3-102-m01 08-TCM3-102-m01 08-TCAP-102-m01 Application-oriented Subje 10-I-GT-102-m01 10-I-DB-102-m01 10-I-WBS-102-m01	Theoretical Chemistry Principles of drug design Programming in Theoretical Chemistry Theoretical Chemistry - Project work Ct Computer Science Algorithmic Graph Theory Databases Knowledge-based Systems	5 5 5 10 5 5 5	NUM NUM B/NB NUM NUM NUM	11 8 13 9 46 43 53



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10-l=DK-102-m01	Data Compression	8	NUM	23		
10-I=PVS-102-m01	Programming of Distributed Systems	8	NUM	33		
10-I=IR-102-m01	Information Retrieval	5	NUM	26		
10-l=Kl-102-m01	Artificial Intelligence	8	NUM	28		
10-I=EL-102-m01	E-Learning	5	NUM	24		
10-l=Ml-102-m01	Medical Informatics	5	NUM	31		
10-I=DDB-102-m01	Deductive Databases	8	NUM	22		
10-l=DB2-102-m01	Databases II	5	NUM	21		
10-I=LVS-102-m01	Analytical Performance Evaluation of Distributed Systems	8	NUM	30		
10-l=ST-102-m01	Simulation Techniques for Performance Evaluation	8	NUM	39		
10-I=AFS-102-m01	Automata Theory and Formal Languages	8	NUM	15		
10-l=BL-102-m01	Computability Theory and Mathematical Logic	8	NUM	19		
10-l=KT2-102-m01	Advanced Topics in Computational Complexity	8	NUM	29		
10-l=KD-102-m01	Cryptography and Data Security	5	NUM	27		
10-I=AG-102-m01	Computational Geometry	5	NUM	16		
10-I=APA-102-m01	Approximation Algorithms	5	NUM	18		
10-l=VG-102-m01	Visualization of Graphs	5	NUM	40		
10-I=AGIS-102-m01	Algorithms for Geographic Information Systems	5	NUM	17		
10-I=CB-102-m01	Compiler Construction	8	NUM	20		
10-I=PA-102-m01	Program Design and Analysis	5	NUM	32		
10-I=RAM-102-m01	5	NUM	34			
Application-oriented Subject Aerospace Computer Science						
10-I-AR-102-m01	Automation and Control Technology	8	NUM	41		
10-I-RAK-102-m01	Computer Architecture	5	NUM	49		
10-I-RK-102-m01	Computer Networks and Communication Systems	8	NUM	51		
10-I=ES-102-m01	Embedded Systems	8	NUM	25		
10-I=RO-102-m01	Robotics	8	NUM	35		
10-l=SSD-102-m01	Spacecraft Systems Design	8	NUM	38		
10-l=AA-102-m01	Advanced Automation	8	NUM	14		
10-I=RO2-102-m01	Robotics II: Networked Robots	8	NUM	37		
Application-oriented Sul	bject Physics		1			
11-ASL-092-m01	Applied Superconduction	6	NUM	165		
11-EPP-092-m01	Introduction to Plasmaphysics	6	NUM	171		
11-AHL-092-m01	Applied Semiconductor Physics	6	NUM	159		
11-FK2-092-m01	Solid State Physics 2	8	NUM	173		
11-FKS-092-m01	Solid State Spectroscopy	6	NUM	175		
11-FKT-092-m01	Transport Phenomena in Solids	6	NUM	177		
11-HNS-092-m01	Semiconductor Nanostructures	6	NUM	181		
11-MAG-092-m01	Magnetism	6	NUM	183		
11-NDS-092-m01	Low-Dimensional Structures	4	NUM	185		
11-NOP-092-m01	Nano-Optics	4	NUM	189		
11-QM2-092-m01	Quantum Mechanics II	8	NUM	193		
11-QPM-092-m01	Quantum Phenomena in electronic correlated Materials	6	NUM	195		
11-QVTP-092-m01	Many Body Quantum Theory	8	NUM	197		
11-RMS-092-m01	Relativistic Effects in Mesoscopic Systems	5	NUM	199		
11-TFK-092-m01	Theoretical Solid State Physics	8	NUM	213		
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11-TSL-092-m01	Theory of Superconduction	5	NUM	219		
11-PKS-092-m01	Physics of Complex Systems	6	NUM	191		
11-SDC-092-m01	Statistics, Data Analysis and Computer Physics	4	NUM	207		
11-AKM-092-m01	Cosmology	6	NUM	161		
11-APL-092-m01	Plasma-Astrophysics	6	NUM	163		
11-ASP-092-m01	Introduction to Space Physics	6	NUM	167		
11-AWP-092-m01	Atmosphere and Space Physics	6	NUM	169		
11-GRT-092-m01	Group Theory	6	NUM	179		
11-NMA-092-m01	Numerical Methods in Astrophysics	6	NUM	187		
11-RNT-092-m01	Renormalization Theory	6	NUM	201		
11-RQFT-092-m01	Relativistical Quantumfield Theory	8	NUM	203		
11-RTT-092-m01	Theory of Relativity	6	NUM	205		
11-TEP-092-m01	Theoretical Elementary Particle Physics	8	NUM	211		
11-TPE-092-m01	Experimental Particle Physics	4	NUM	215		
11-TPS-092-m01	Particle Physics (Standard Model)	8	NUM	217		
11-SUS-092-m01	11-SUS-092-m01 Supersymmetry I and II		NUM	209		
Application-oriented Wor	Application-oriented Work Placement (10 ECTS credits)					
10-M=EPRK-102-m01	Internship (Lab Course) Applied Mathematics	10	NUM	90		



Module title					Abbreviation
Principles of drug design				_	08-MCM3-102-m01
Modul	e coord	dinator		Module offered by	
lecturers Pharmazeutische Chemie (Pharmaceutical Chemistry)		ie (Pharmaceutical Che-	Institute of Pharmacy and Food Chemistry		
ECTS	Meth	od of grading	Only after succ. cor	mpl. of module(s)	
5	nume	erical grade			
Duratio	on	Module level	Other prerequisites	5	
1 semester graduate					
Conter	nts	•			

Fundamentals: drug targets (types and classification), target validation, effect mechanisms, protein-ligand interactions, lead finding; lead optimisation. Experimental methods: bioassays, HTS, combinatorial chemistry, naturally occurring substances. Theoretical methods: molecular modelling, structure-based drug design, pharmacophore models, docking, virtual screening, simulation methods, de novo design. Ligand-based drug design. QSAR. Predictions of pharmacokinetic and toxicological components (ADME). Case examples, prodrug strategies, bioisosterism, SAR.

Intended learning outcomes

Students master the theoretical and experimental methods and aspects of drug design.

Courses (type, number of weekly contact hours, language — if other than German)

S + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

presentation with discussion (approx. 30 minutes) Language of assessment: German or English

Allocation of places

Chemistry Master's and Mathematics Master's: no restrictions. Biochemistry Master's: 10 places. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Biochemistry (2012)

Master's degree (1 major) Chemistry (2010)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) FOKUS Pharmacy (2012)



Module title				Abbreviation	
Theoretical Chemistry - Project work					08-TCAP-102-m01
Module coordinator				Module offered by	
head o	f the re	search group offering the	e module	Institute of Physical and Theoretical Chemistry	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
10	(not)	successfully completed			
Duration Module level		Other prerequisites			
1 semester graduate					
Conter	Contents				

This module gives students the opportunity to get involved in the work of one of the research groups based at the Institute of Theoretical Chemistry and learn some of the methods typically used in the discipline.

Intended learning outcomes

Students have learned some of the methods typically used in theoretical chemistry. They are able to explain issues that are relevant to the fields covered.

Courses (type, number of weekly contact hours, language — if other than German)

This module has 3 components; information on courses listed separately for each component.

- 08-TCAP-1-102: P (no information on language and number of weekly contact hours available)
- o8-TCAP-2-102: P (no information on language and number of weekly contact hours available)
- 08-TCAP-3-102: P (no information on language and number of weekly contact hours available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

This module has the following 3 assessment components. To pass the module as a whole students must pass two out of these three assessment components.

Assessment component to module component o8-TCAP-1-102: Theoretische Chemie Arbeitsgruppenpraktikum Wellenpaketdynamik

- 5 ECTS credits, method of grading: (not) successfully completed
- presentation (approx. 30 minutes)
- Language of assessment: German or English

Assessment component to module component o8-TCAP-2-102: Theoretische Chemie Arbeitsgruppenpraktikum Wellenfunktionsmethoden

- 5 ECTS credits, method of grading: (not) successfully completed
- presentation (approx. 30 minutes)
- Language of assessment: German or English

Assessment component to module component o8-TCAP-3-102: Theoretische Chemie Arbeitsgruppenpraktikum Dichtefunktionaltheorie

- 5 ECTS credits, method of grading: (not) successfully completed
- presentation (approx. 30 minutes)
- Language of assessment: German or English

Allocation of places

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Additional information

Additional information on module duration: 4 weeks..

Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Chemistry (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)



Module	Module title Abbreviation				Abbreviation
Theore	Theoretical Chemistry				08-TCM1-102-m01
Module coordinator				Module offered by	
lecture	r of lec	ture "Theoretische Chemi	e"	Institute of Physica	l and Theoretical Chemistry
ECTS	Metho	od of grading	Only after succ. com	ıpl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			successful completion of exerci-
			•	· ·	d at the beginning of the course
			* *		fully completed) as well as regu-
				ercises (usually a ma	aximum of 2 incidents of unexcu-
			sed absence).		
Conten	ts				
This mo	odule ii	ntroduces students to the	e fundamental princip	oles of theoretical ch	emistry.
Intende	ed lear	ning outcomes			
		able to describe the math amical approaches of the		al principles underly	ing the quantum chemical and
Course	s (type	, number of weekly conta	ct hours, language –	if other than Germa	n)
		mation on SWS (weekly o			
Metho	d of ass		nguage — if other tha	an German, examina	tion offered — if not every seme-
		nation (90 minutes) ssessment: German or Eı	nglish		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachi	ng cvcl	 e			
	3 -)				
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				
Module	Module appears in				
1	Master's degree (1 major) Chemistry (2010)				
	Master's degree (1 major) Mathematics (2012)				
1	_	ee (1 major) Mathematics		`	
		ee (1 major) Computation		2)	
waster	Master's degree (1 major) FOKUS Pharmacy (2012)				



Module	e title	,			Abbreviation	
Compu	Computational Chemistry				08-TCM2-102-m01	
Module	Module coordinator			Module offered by		
lecture	r of lec	ture "Computational Che	emistry"	Institute of Physica	l and Theoretical Chemistry	
ECTS	,	od of grading	Only after succ. con	pl. of module(s)		
5	nume	rical grade				
Duratio	-	Module level	Other prerequisites			
1 seme	ester	graduate	Admission prerequisite to assessment: successful completion of exercises in the respective classes as specified at the beginning of the course (usually 70% of exercises to be successfully completed) as well as regular attendance of exercises (usually a maximum of 2 incidents of unexcused absence).			
Conten	ıts					
This m	odule i	ntroduces students to th	e fundamental princip	oles of computationa	al chemistry.	
Intend	ed lear	ning outcomes				
		able to explain the theor	etical principles of co	mputational chemist	try and to apply methods in com-	
Course	s (type	, number of weekly cont	act hours, language –	if other than Germa	ın)	
S + Ü (ı	no info	rmation on SWS (weekly	contact hours) and co	urse language avail	able)	
		sessment (type, scope, l ion on whether module o			ition offered — if not every seme-	
		nation (90 minutes) Issessment: German or E	nglish			
Allocat	tion of	places				
			_			
Additio	onal inf	ormation				
	_					
Worklo	ad					
Teachi	ng cycl	e				
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	Module appears in					
Master	Master's degree (1 major) Chemistry (2010)					
	_	ee (1 major) Mathematic				
	_	ee (1 major) Mathematic		`		
Master	Master's degree (1 major) Computational Mathematics (2012)					



Module title					Abbreviation		
Progra	mming	in Theoretical Chemis	stry		o8-TCM3-102-m01		
Modul	e coord	linator		Module offered by			
		,	n Theoretischer Che-	† <u>'</u>	l and Theoretical Chemistry		
lecturer of lecture "Programmieren in Theoretischer Che- mie"			ii iiieoretischer che-	liistitute of i flysica	it and Theoretical Chemistry		
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)			
5	nume	rical grade					
Duratio	on	Module level	Other prerequisites	5			
1 seme	ester	graduate					
Conter	ıts						
		provides an introduction areas.	on to the fundamentals	of programming in th	neoretical chemistry and discus-		
		ning outcomes					
		able to explain and us		ng languages typical	ly used in theoretical chemistry		
Course	s (type	, number of weekly co	ntact hours, language -	– if other than Germa	an)		
S + Ü (no info	rmation on SWS (week	kly contact hours) and c	ourse language avail	able)		
ster, in	format etion a	ion on whether modul nd discussion of appro	e can be chosen to earn ox. 5 programming exerc	a bonus)	ation offered — if not every seme- (approx. 45 minutes)		
	age or a	assessment: German o	r English				
Alluca	LIUII UI	piaces					
V 4 4;+;		ormation					
Additio	onat ini	ormation					
Worklo							
WOIKIG	Jau						
 T		-					
	ng cycl	le					
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
	Master's degree (1 major) Chemistry (2013)						
	Master's degree (1 major) Chemistry (2010) Master's degree (1 major) Chemistry (2014)						
	_	ee (1 major) Mathema ee (1 major) Mathema					
Mastel	Master's degree (1 major) Mathematics (2010)						



Module	e title				Abbreviation
Advanced Automation			10-I=AA-102-m01		
Module	Module coordinator Module offered by				
holder	of the	Chair of Computer Scien	of Computer Science VII Institute of Computer Science		
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
8	nume	rical grade			
Duratio	on	Module level	Other prerequisites	;	
1 seme	1 semester graduate		Where applicable, prerequisites as specified by the lecturer at the begin-		
			ning of the course (e.g. completion of exercises).		
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Advanced topics in automation systems as well as instrumentation and control engineering, for example from the field of sensor data processing, actuators, cooperating systems, mission and trajectory planning.

Intended learning outcomes

The students have an advanced knowledge of selected topics in automation systems. They are able to implement advanced automation systems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)



Module title					Abbreviation	
Automata Theory and Formal Languages					10-I=AFS-102-m01	
Module coordinator				Module offered by		
holder	of the	Chair of Computer Scienc	e IV	Institute of Comput	ter Science	
ECTS	Meth	od of grading	Only after succ. con	ipl. of module(s)		
8	nume	rical grade				
Duratio	on .	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, prerequisites as specified by the lecturer at the be		ified by the lecturer at the begin-	
			ning of the course (e.g. completion of exercises).			
Conten	its					

Chomsky's theories of grammar and language classes, grammar normal forms, finite automata, pushdown automata, linear bound automaton, closure properties of language classes, decidability questions, minimisation of finite automata, regular sets, star-free languages, language acceptance by monoids, logic description of regular languages.

Intended learning outcomes

The students have a fundamental and applicable knowledge in the areas of Chomsky's grammar and language classes, of grammar normal forms, finite automata, push-down automata, linear bound automata, closure properties of language classes, decidability questions, minimising of finite automata, regular sets, star-free languages, language acceptance by monoids and logic descriptions of regular languages.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner
Allocation of places
Additional information
Workload
Teaching cycle
Referred to in LPO I (examination regulations for teaching-degree programmes)
Module appears in

Master's degree (1 major) Computer Science (2010) Master's degree (1 major) Mathematics (2010)



Modul	e title		Abbreviation			
Computational Geometry				•	10-I=AG-102-m01	
Module coordinator Module offered by						
holder of the Chair of Computer Science I			nce I	Institute of Computer Science		
ECTS	Meth	od of grading	Only after succ. con	ompl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, prerequisites as specified by the lecturer at the begin			
			ning of the course (e.g. completion of exercises).			
<u> </u>						

In many areas of computer science -- for example robotics, computer graphics, virtual reality and geographic information systems -- it is necessary to store, analyse, create or manipulate spatial data. This class is about the algorithmic aspects of these tasks: We will acquire techniques that are needed to plan and analyse geometric algorithms and data structures. Every technique will be illustrated with a problem in the practical areas listed above.

Intended learning outcomes

The students are able to decide which algorithms or data structures are suitable for the solution of a given geometric problem. The students are able to analyse new problems and to come up with their own efficient solutions based on the concepts and techniques acquired in the lecture.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



Modul	e title		Abbreviation			
Algorithms for Geographic Information Systems					10-l=AGIS-102-m01	
Module coordinator Modu				Module offered by		
holder	holder of the Chair of Computer Science I			Institute of Computer Science		
ECTS	Meth	od of grading	Only after succ. compl. of module(s)			
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	graduate	Where applicable, prerequisites as specified by the lecturer at the begi		ified by the lecturer at the begin-	
			ning of the course (e. g. completion of exercises).			
Contor	Contents					

Algorithmic foundations of geographic information systems and their application in selected problems of acquisition, processing, analysis and presentation of spatial information. Processes of discrete and continuous optimisation. Applications such as the creation of digital height models, working with GPS trajectories, tasks of spatial planning as well as cartographic generalisation.

Intended learning outcomes

The students are able to formalise algorithmic problems in the field of geographic information systems as well as to select and improve suitable approaches to solving these problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes) Language of assessment: German, English if agreed upon with the examiner

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



title				Abbreviation	
imatio	n Algorithms			10-I=APA-102-m01	
Module coordinator Module offered					
holder of the Chair of Computer Science I			Institute of Computer Science		
Metho	od of grading	Only after succ. con	npl. of module(s)		
nume	rical grade				
n	Module level	Other prerequisites			
ster	graduate	Where applicable, prerequisites as specified by the lecturer at the begin			
		ning of the course (ning of the course (e.g. completion of exercises).		
	coord of the (Metho nume	imation Algorithms coordinator of the Chair of Computer Scien Method of grading numerical grade n Module level	imation Algorithms coordinator of the Chair of Computer Science I Method of grading numerical grade n Module level other prerequisites ster graduate Where applicable, p	imation Algorithms coordinator of the Chair of Computer Science I Method of grading numerical grade n Module level of the Chair of Computer Science I Institute of Computer Science I Only after succ. compl. of module(s) of Module level Other prerequisites ster graduate Where applicable, prerequisites as specific specifi	

The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming.

Intended learning outcomes

The students are able to analyse easy approximation methods in terms of their quality. They understand fundamental drafting techniques such as greedy, local search and scaling as well as methods based on linear programming and are able to apply these to new problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module	e title		Abbreviation				
Computability Theory and Mathematical Logic					10-I=BL-102-m01		
Module coordinator Module offered by							
holder of the Chair of Computer Science IV			ce IV	Institute of Computer Science			
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)			
8	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate	Where applicable, prerequisites as specified by the lecturer at the begin				
			ning of the course (e.g. completion of exercises).				

Gödel numbering, decidable and countable sets, halting problem, m-reducibility and completeness, create and productive sets, relative computability, Turing reduction, countable degrees, theorem by Friedberg and Muchnik, arithmetic hierarchy, propositional logic, first-order predicate logic, proof and deduction, Gödel's completeness theorem, Tarski theorem, Gödel's incompleteness theorem, undecidability and nonaxiomatisability of elemental arithmetic.

Intended learning outcomes

The students possess a fundamental and applicable knowledge in the areas of Gödel numbering, decidable and countable sets, halting problem, m-reducibility and completeness, creative and productive sets, relative computability, Turing reducibility, countable degrees, theorem by Friedberg and Muchnik, arithmetic hierarchy, propositional logic, first-order predicate logic, proof and deduction, Gödel's completeness theorem, Tarski theorem, Gödel's incompleteness theorem, undecidability and nonaxiomatisability of elemental arithmetic.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2010)



Modul	e title		Abbreviation			
Compiler Construction					10-I=CB-102-m01	
Modul	e coord	inator		Module offered by		
holder	of the	Chair of Computer Scienc	e II	Institute of Computer Science		
ECTS	Meth	od of grading	Only after succ. con	mpl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, prerequisites as specified by the lecturer at the begin			
			ning of the course (e.g. completion of exercises).			
C 4						

Lexical analysis, syntactic analysis, semantics, compiler generators, code generators, code optimisation.

Intended learning outcomes

The students possess knowledge in the formal description of programming languages and their compilation. They are able to perform transformations between them with the help of finite automata, push-down automata and compiler generators.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module title					Abbreviation	
Databases II					10-I=DB2-102-m01	
Module coordinator				Module offered by		
Dean of Studies Informatik (Computer Sci			Science)	Institute of Computer Science		
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, prerequisites as specified by the lecturer at the beg		ified by the lecturer at the begin-	
ning of t		ning of the course (e.g. completion of exercises).				
Contents						
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Data warehouses and data mining; XML databases; web databases; introduction to Datalog.

Intended learning outcomes

The students have advanced knowledge about relational databases, XML and data mining.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Business Information Systems (2011)

Master's degree (1 major) Business Information Systems (2013)

Master's degree (1 major) Computational Mathematics (2012)

Master's degree (1 major) Functional Materials (2012)



Module	Module title Abbreviation					
Deductive Databases					10-l=DDB-102-m01	
Module	e coord	inator		Module offered by		
Dean of Studies Informatik (Computer Scien			Science)	Institute of Computer Science		
ECTS	Meth	od of grading	Only after succ. compl. of module(s)			
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, prerequisites as specified by the lecturer at the beg		ified by the lecturer at the begin-	
			ning of the course (e.g. completion of exercises).			
Conton	Contents					

Syntax and semantics of logic programs; data structures, program structures and applications for Prolog; analytical methods for Datalog; negation and stratification; disjunctive logic programs.

Intended learning outcomes

The students possess expertise in working with Prolog and Datalog (including negation and disjunction).

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module	e title		Abbreviation			
Data Co	ompres	ssion			10-I=DK-102-m01	
Module coordinator Module offered by						
holder of the Chair of Computer Science II			ce II	Institute of Computer Science		
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites	Other prerequisites		
1 semester		graduate	Where applicable, prerequisites as specified by the lecturer at the begin			
			ning of the course (e. g. completion of exercises).			

Entropy coding, text compression, dictionary methods, block transformations, image compression, human visual system, bitplane techniques, predicative methods, hierarchical transformations, discrete cosine transform, wavelets, JPEG baseline, JPEG 200, subband coding, fractal compression, vector quantisation, video compression, MPEG standards, audio compression.

Intended learning outcomes

The students possess the methodic knowledge and practical skills for the development and use of compression methods for text, image, video and audio data.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2010)



Module	e title		Abbreviation			
E-Learning					10-l=EL-102-m01	
Module	e coord	inator		Module offered by		
holder	of the	Chair of Computer Scienc	e VI	Institute of Computer Science		
ECTS	Meth	od of grading	Only after succ. con	cc. compl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, prerequisites as specified by the lecturer at the begin			
			ning of the course (e. g. completion of exercises).			
<u> </u>						

Learning paradigms, learning system types, author systems, learning platforms, standards for learning systems, intelligent tutoring systems, student models, didactics, problem-oriented learning and case-based training systems, adaptive tutoring systems, computer-supported cooperative learning, evaluation of learning systems.

Intended learning outcomes

The students possess a theoretical and practical knowledge about eLearning and are able to assess possible applications.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Business Information Systems (2011)

Master's degree (1 major) Business Information Systems (2013)

Master's degree (1 major) Computational Mathematics (2012)

Master's degree (1 major) Functional Materials (2012)



Module title					Abbreviation	
Embedded Systems					10-I=ES-102-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Informatik (Compute	r Science)	Institute of Computer Science		
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, prerequisites as specified by the lecturer at the begi			
			ning of the course (e	ning of the course (e. g. completion of exercises).		

Models of embedded systems, implementation methods (ASIC, AISIP, micro controller), verification of embedded systems, implementation planning static, periodic and dynamic, binding problems, hardware synthesis, software synthesis.

Intended learning outcomes

The students are familiar with the technical possibilities for the design of embedded systems and master the most important techniques for the modelling, verification and optimisation of such systems in hardware and software.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module title					Abbreviation
Informa	ation R	etrieval			10-I=IR-102-m01
Module coordinator Module offer				Module offered by	
Dean of Studies Informatik (Computer Scient			Science)	Institute of Computer Science	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate	Where applicable, prerequisites as specified by the lecturer at the begin		
			ning of the course (e. g. completion of exercises).		
	ming of the course (e. g. completion of exercises).				

IR models (e. g. Boolean and vector space model, evaluation), processing of text (tokenising, text properties), data structures (e. g. inverted index), query elements (e. g. query operations, relevance feedback, query languages and paradigms, structured queries), search engine (e. g. architecture, crawling, interfaces, link analysis), methods to support IR (e. g. recommendation systems, text clustering and classification, information extraction).

Intended learning outcomes

The students possess theoretical and practical knowledge in the area of information retrieval and have acquired the technical know-how to create a search engine.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Business Information Systems (2011)

Master's degree (1 major) Business Information Systems (2013)

Master's degree (1 major) Functional Materials (2012)



title				Abbreviation
graphy	and Data Security			10-I=KD-102-m01
coord	inator	Module offered by	dule offered by	
f Studi	es Informatik (Computer	Science)	Institute of Computer Science	
Metho	od of grading	Only after succ. con	npl. of module(s)	
nume	rical grade			
n	Module level	Other prerequisites		
1 semester graduate		Where applicable, prerequisites as specified by the lecturer at the begin-		
		ning of the course (e. g. completion of exercises).		
	coord f Studio Metho nume	graphy and Data Security coordinator f Studies Informatik (Computer: Method of grading numerical grade n Module level	graphy and Data Security coordinator f Studies Informatik (Computer Science) Method of grading numerical grade n Module level Ster graduate Other prerequisites Where applicable, p	graphy and Data Security Secondinator F Studies Informatik (Computer Science) Method of grading numerical grade n Module level Ster graduate Module Security Module offered by Institute of Computer Science) Only after succ. compl. of module(s) Other prerequisites Where applicable, prerequisites as specifically as specifically and security and

Private key cryptography systems, Vernam one-time pad, AES, perfect security, public key cryptography systems, RSA, Diffie-Hellman, Elgamal, Goldwasser-Micali, digital signature, challenge-response methods, secret sharing, millionaire problem, secure circuit evaluation, homomorphous encryption.

Intended learning outcomes

The students possess a fundamental and applicable knowledge in the areas of private key cryptography systems, Vernam one-time pad, AES, perfect security, public key cryptography, RSA, Diffie-Hellman, Elgamal, Goldwasser-Micali, digital signature, challenge-response method, secret sharing, millionaire problem, secure circuit evaluation, homomorphous encryption

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



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2-11101		
Institute of Computer Science		
Other prerequisites		
Where applicable, prerequisites as specified by the lecturer at the begin-		
ning of the course (e.g. completion of exercises).		

Intelligent agents, uninformed and heuristic search, constraint problem solving, search with partial information, propositional and predicate logic and inference, knowledge representation, planning, probabilistic closure and Bayesian networks, utility theory and decidability problems, learning from observations, knowledge while learning, neural networks and statistical learning methods, reinforcement learning.

Intended learning outcomes

The students possess theoretical and practical knowledge about artificial intelligence and are able to assess possibilities for its application.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module title					Abbreviation	
Advand	ced Top	oics in Computational Co		10-l=KT2-102-m01		
Module coordinator Module o				Module offered by	odule offered by	
Dean of Studies Informatik (Computer Science)			Science)	Institute of Computer Science		
ECTS	Meth	ethod of grading Only after succ. co		npl. of module(s)		
8	nume	nerical grade				
Duratio	on	Module level	Other prerequisites	ther prerequisites		
1 seme	1 semester graduate		Where applicable, prerequisites as specified by the lecturer at the begin-			
	ning of the course (e. g. completion of exercises).				xercises).	
Conten	Contents					

Properties of NP-complete sets, autoreducibility, interactive proof systems, polynomial time hierarchy, complexity of probabilistic algorithms.

Intended learning outcomes

The students possess a fundamental and applicable knowledge in the areas of properties of NP-complete sets, autoreducibility, interactive proof systems, polynomial time hierarchies, complexity of probabilistic algorithms.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2010)



Modul	e title	,	Abbreviation		
Analytical Performance Evaluation of Distributed Systems					10-l=LVS-102-m01
Module coordinator Module offered by					
holder of the Chair of Computer Science III			ce III	Institute of Computer Science	
ECTS	Meth	hod of grading Only after succ. co		npl. of module(s)	
8	nume	erical grade			
Duration	on	Module level	Other prerequisites	Other prerequisites	
1 semester		graduate	Where applicable, prerequisites as specified by the lecturer at the begin		
ning of the course (e. g. completion of exercises).		xercises).			
Contor		•	•		

Traffic theoretic models, fundamental concepts of theory of probability, transformation techniques, stochastic processes, methods for performance analysis of technical systems, queue-/traffic theory, analysis of Markov, non-Markov and time critical systems, matrix analytical method, practical examples for performance analysis of computer systems and networks: throughput and goodput analysis and other characteristics.

Intended learning outcomes

The students possess the methodic knowledge and the practical skills necessary to model technical systems by means of the theory of probability and mathematical statistics.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2010)



Modul	Module title Abbreviation					
Medical Informatics					10-l=Ml-102-m01	
Module coordinator Module offered by						
holder of the Chair of Computer Science VI			ce VI	Institute of Computer Science		
ECTS	Meth	hod of grading Only after succ.		mpl. of module(s)		
5	nume	rical grade				
Duration Module level O			Other prerequisites			
1 semester g		graduate	Where applicable, prerequisites as specified by the lecturer at the begin			
			ning of the course (e.g. completion of exercises).			

Electronic patient folder, coding of medical data, hospital information systems, operation of computers in infirmary and functional units, medical decision making and assistance systems, statistics and data mining in medical research, case-based training systems in medical training.

Intended learning outcomes

The students possess theoretical and practical knowledge about the application of computer science methods in medicine.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)



Module	e title				Abbreviation	
Program Design and Analysis					10-l=PA-102-m01	
Module coordinator				Module offered by		
holder of the Chair of Computer Science II			e II	Institute of Computer Science		
ECTS	Meth	hod of grading Only after succ. co		npl. of module(s)		
5	nume	rical grade				
Duratio	Duration Module level Other prereq					
1 semester graduate		Where applicable, prerequisites as specified by the lecturer at the begin-				
ning of the course (e. g. completion of exercises).			xercises).			
Conten	Contents					

Program analysis, model creation in software engineering, program quality, test of programs, process models.

Intended learning outcomes

The students are able to analyse programs, to use testing frameworks and metrics as well as to judge program quality.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Business Information Systems (2011)

Master's degree (1 major) Business Information Systems (2013)

Master's degree (1 major) Computational Mathematics (2012)



Modul	e title	'	Abbreviation		
Progra	mming	of Distributed Systems		10-I=PVS-102-m01	
Module coordinator Module offered b					
holder of the Chair of Computer Science II			e II	Institute of Computer Science	
ECTS	Meth	hod of grading Only after succ. co		npl. of module(s)	
8	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 semester		graduate	Where applicable, prerequisites as specified by the lecturer at the begin		
	ning of the course (e. g. completion of exercises).		xercises).		
C 4					

Design and development of parallely and distributedly executed programs.

Intended learning outcomes

The students possess the methodic knowledge and practical skills for the design and development of parallely and distributedly running programs.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)



Module	Module title Abbreviation					
Computer Arithmetic					10-I=RAM-102-m01	
Module coordinator Module offere				Module offered by		
holder of the Chair of Computer Science II			e II	Institute of Computer Science		
ECTS	Meth	ethod of grading Only after succ.		mpl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 semester graduate		Where applicable, prerequisites as specified by the lecturer at the begin-				
		ning of the course (e.g. completion of exercises).			xercises).	
Contor	Contents					

Spaces of numerical computation, raster and rounding, definition and implementation of computational arithmetic and interval calculation.

Intended learning outcomes

The students possess knowledge about the spaces of numerical computation, raster and roundings, definition and implementation of computational arithmetic and interval calculation. They master the application of algorithms.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

 $\textbf{Method of assessment} \ (\textbf{type}, \textbf{scope}, \textbf{language} - \textbf{if other than German, examination offered} - \textbf{if not every seme-}$ ster, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes) Language of assessment: German, English if agreed upon with the examiner

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module	e title		Abbreviation			
Robotics					10-l=RO-102-m01	
Module coordinator Module offered by						
holder of the Chair of Computer Science VII			cience VII	Institute of Computer Science		
ECTS	Method of grading Only after succ. co			npl. of module(s)		
8	nume	rical grade				
Duration Module level Ot			Other prerequisites	Other prerequisites		
1 semester graduate		Where applicable, p	Where applicable, prerequisites as specified by the lecturer at the begin-			
			ning of the course (ning of the course (e. g. completion of exercises).		

History, applications and properties of robots, direct kinematics of manipulators: coordinate systems, rotations, homogenous coordinates, axis coordinates, arm equation. Inverse kinematics: solution properties, end effector configuration, numerical and analytical approaches, examples of different robots for analytical approaches. Workspace analysis and trajectory planning, dynamics of manipulators: Lagrange-Euler model, direct and inverse dynamics. Mobile robots: direct and inverse kinematics, propulsion system, tricycle, Ackermann steering, holonomes and non-holonome restrictions, kinematic classification of mobile robots, posture kinematic model. Movement control and path planning: roadmap methods, cell decomposition methods, potential field methods. Sensors: position sensors, speed sensors, distance sensors.

Intended learning outcomes

The students master the fundamentals of robot manipulators and vehicles and are, in particular, familiar with their kinematics and dynamics as well as the planning of paths and task execution.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Aerospace Computer Science (2009)

Bachelor' degree (1 major) Aerospace Computer Science (2011)

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)





Module title					Abbreviation	
Robotics II: Networked Robots					10-l=RO2-102-m01	
Module	e coord	inator		Module offered by		
holder	holder of the Chair of Computer Science VII			Institute of Computer Science		
ECTS	Metho	od of grading	Only after succ. co	mpl. of module(s)		
8	nume	rical grade				
Duratio	Duration Module level Other prerequisite			es		
1 semester graduate		Where applicable,	Where applicable, prerequisites as specified by the lecturer at the begin-			
			ning of the course	ning of the course (e. g. completion of exercises).		

Foundations of dynamic systems, controllability and observability, controller design through pole assignment: feedback and feed-forward, state observer, feedback with state observer, time discrete systems, stochastic systems: foundations of stochastics, random processes, stochastic dynamic systems, Kalman filter: derivation, initialising, application examples, problems of Kalman filters, extended Kalman filter.

Intended learning outcomes

The students master all fundamentals that are necessary to understand Kalman filters and their use in applications of robotics. The students possess a knowledge of advanced controller and observer methods and recognise the connections between the dual pairs controllability - observability as well as controller design and observer design. They also recognise the relationship between the Kalman filter as a state estimator and an observer.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module title					Abbreviation	
Spacecraft Systems Design					10-l=SSD-102-m01	
Module coordinator				Module offered by		
holder	holder of the Chair of Computer Science VII			Institute of Computer Science		
ECTS	Metho	od of grading	Only after succ. c	ompl. of module(s)	mpl. of module(s)	
8	nume	rical grade				
Duratio	on	Module level	Other prerequisit	es		
1 seme	1 semester graduate		Where applicable	Where applicable, prerequisites as specified by the lecturer at the begin-		
	ļ		ning of the course	ning of the course (e. g. completion of exercises).		

Introduction: history of space flight, system design of spacecraft. Space dynamics: two-body dynamics, Kepler orbits, disturbance forces, transfer orbits. Mission analysis: earth and sun-synchronous orbits, shadows, solar angle of incidence. Thermal control of satellites: thermal analysis, thermal design and technologies, verification of thermal designs. Telecommunication: ground contact analysis, data transmission, satellite monitoring (telemetry, telecommando). Structure and mechanisms. Energy systems: primary, secondary, management, power generation: solar cells. On-board data processing. Propulsion systems. Tests (mechanical, electrical). Operation of spacecraft. Ground segment.

Intended learning outcomes

The students master system aspects of the layouting of technical systems. Using the example of spacecraft, major subsystems and their integration into a working whole are being analysed.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)



Module title					Abbreviation	
Simulation Techniques for Performance Evaluation					10-l=ST-102-m01	
Module	coord	inator		Module offered by		
holder	of the (Chair of Computer S	cience III	Institute of Computer Science		
ECTS	Metho	od of grading	Only after succ. co	mpl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisite	es		
1 seme	1 semester graduate		Where applicable,	Where applicable, prerequisites as specified by the lecturer at the begin-		
			ning of the course	ning of the course (e. g. completion of exercises).		

Introduction to simulation techniques, statistical groundwork, creation of random numbers and random variables, random sample theory and estimation techniques, statistical analysis of simulation values, inspection of measured data, planning and evaluation of simulation experiments, special random processes, possibilities and limits of model creation and simulation, advanced concepts and techniques, practical execution of simulation projects.

Intended learning outcomes

The students possess the methodic knowledge and the practical skills necessary for the stochastic simulation of (technical) systems, the evaluation of results and the correct assessment of the possibilities and limits of simulation methods.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module title Abbreviat					Abbreviation
Visualization of Graphs					10-l=VG-102-m01
Modul	e coord	linator		Module offered by	
holder	of the	Chair of Computer Scienc	e I	Institute of Comput	er Science
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 semester graduate		Where applicable, prerequisites as specified by the lecturer at the begin-			
			ning of the course (e.g. completion of exercises).		
Conter	Contents				

This course covers the most important algorithms to draw graphs. Methods from the course Algorithmische Graphentheorie (Algorithmic Graph Theory) such as divide and conquer, flow networks, integer programming and the planar separator theorem will be used. We will become familiar with measures of quality of a graph drawing as well as algorithms to optimise these measures.

Intended learning outcomes

The participants get an overview of graph visualisation and become familiar with typical tools. They consolidate their knowledge about the modelling and solving of problems with the help of graphs and graph algorithms.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes) Language of assessment: German, English if agreed upon with the examiner

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2010)



Automation and Control Technology Module coordinator Module offered by holder of the Chair of Computer Science VII Institute of Computer Science ECTS Method of grading Only after succ. compl. of module(s) numerical grade Duration Module level Other prerequisites 1 semester undergraduate Admission prerequisite to assessment: exercises (type and scope to be	Module title					Abbreviation
holder of the Chair of Computer Science VII ECTS Method of grading Only after succ. compl. of module(s) 8 numerical grade Duration Module level Other prerequisites	Automation and Control Technology					10-I-AR-102-m01
ECTS Method of grading Only after succ. compl. of module(s) 8 numerical grade Duration Module level Other prerequisites	Module coordinator Module offe				Module offered by	
8 numerical grade Duration Module level Other prerequisites	holder of the Chair of Computer Science VII			e VII	Institute of Computer Science	
Duration Module level Other prerequisites	ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
	8	nume	rical grade			
1 semester undergraduate Admission prerequisite to assessment: exercises (type and scope to be	Duratio	n	Module level	Other prerequisites		
	1 semester undergraduate		Admission prerequisite to assessment: exercises (type and scope to be			
announced by the lecturer at the beginning of the course).				announced by the lecturer at the beginning of the course).		

Overview of automation systems, fundamental principles of control technology, Laplace transformation, transfer function, plant, controller types, basic feedback loop, fundamental principles of control engineering, automata, structure of Petri nets, Petri nets for automisation, machine-related structure of processing computation machines, communication between process computers and periphery devices, software for automation systems, process synchronisation, process communication, real-time operating systems, real-time planning.

Intended learning outcomes

The students master the fundamentals of automation and control.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Computer Science (2010)

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Computational Mathematics (2012)

Bachelor' degree (1 major) Computational Mathematics (2013)

Bachelor' degree (1 major) Aerospace Computer Science (2009)

Bachelor' degree (1 major) Aerospace Computer Science (2011)

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)



Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module title					Abbreviation	
Databa	ises				10-I-DB-102-m01	
Modul	e coord	inator		Module offered by		
Dean o	f Studi	es Informatik (Computer	Science)	Science) Institute of Computer Science		
ECTS	ECTS Method of grading Only after succ. co			npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester undergraduate		Admission prerequisite to assessment: exercises (type and scope to be				
			announced by the lecturer at the beginning of the course).			

Relational algebra and complex SQL statements; database planning and normal forms; transaction management

Intended learning outcomes

The students possess knowledge about database modelling and queries in SQL as well as transactions.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes)

if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 49 (1) 1. b) Datenbanksysteme und Softwaretechnologie

§ 69 (1) 1. b) Datenbanksysteme und Softwaretechnologie

Module appears in

Bachelor' degree (1 major) Computer Science (2010)

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Business Information Systems (2013)

Bachelor' degree (1 major) Computational Mathematics (2012)

Bachelor' degree (1 major) Computational Mathematics (2013)

Bachelor' degree (1 major) Aerospace Computer Science (2009)

Bachelor' degree (1 major) Aerospace Computer Science (2011)

Bachelor' degree (1 major) Functional Materials (2012)

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)



Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Computational Mathematics (2012)

First state examination for the teaching degree Realschule Computer Science (2012)



Module title					Abbreviation	
Data Mining				-	10-I-DM-102-m01	
Module	e coord	inator		Module offered by		
holder	holder of the Chair of Computer Science VI			Institute of Computer Science		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites	;		
1 semester undergraduate		Admission prerequisite to assessment: exercises (type and scope to be				
			announced by the le	announced by the lecturer at the beginning of the course).		

Foundations in the following areas: definition of data mining and knowledge, discovery in databases, process model, relationship to data warehouse and OLAP, data preprocessing, data visualisation, unsupervised learning methods (cluster and association methods), supervised learning (e. g. Bayes classification, KNN, decision trees, SVM), learning methods for special data types, other learning paradigms.

Intended learning outcomes

The students possess a theoretical and practical knowledge of typical methods and algorithms in the area of data mining and machine learning. They are able to solve practical knowledge discovery problems with the help of the knowledge acquired in this course and by using the KDD process. They have acquired experience in the use or implementation of data mining algorithms.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Computer Science (2010)

Bachelor' degree (1 major) Business Information Systems (2013)

Bachelor' degree (1 major) Aerospace Computer Science (2009)

Bachelor' degree (1 major) Aerospace Computer Science (2011)

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module title				Abbreviation		
Algorithmic Graph Theory					10-l-GT-102-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Informatik (Computer :	Science) Institute of Computer Science		er Science	
ECTS	ECTS Method of grading Only after succ. con			npl. of module(s)		
5	nume	rical grade				
Duration Module level Other p			Other prerequisites	Other prerequisites		
1 seme	1 semester undergraduate		Admission prerequisite to assessment: exercises (type and scope to be			
			announced by the lecturer at the beginning of the course).			

We discuss typical graph problems: We solve round trip problems, calculate maximal flows, find matchings and colourings, work with planar graphs and find out how the ranking algorithm of Google works. Using the examples of graph problems, we also become familiar with new concepts, for example how we model problems as linear programs or how we show that they are fixed parameter computable.

Intended learning outcomes

The students are able to model typical problems in computer science as graph problems. In addition, the participants are able to decide which tool from the course helps solve a given graph problem algorithmically. In this course, students learn in detail how to estimate the run time of given graph algorithms.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Computer Science (2010)

Bachelor' degree (1 major) Aerospace Computer Science (2009)

Bachelor' degree (1 major) Aerospace Computer Science (2011)

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2010)



Module title					Abbreviation	
Theory of Complexity					10-I-KT-102-m01	
Module	e coord	inator		Module offered by		
Dean o	Dean of Studies Informatik (Computer Science			ience) Institute of Computer Science		
ECTS	Metho	od of grading	Only after succ. con	. compl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites	Other prerequisites		
1 semester undergraduate		Admission prerequisite to assessment: exercises (type and scope to be				
			announced by the lecturer at the beginning of the course).			

Complexity measurements and classes, general relationships between space and time classes, memory consumption versus computation time, determinism versus indeterminism, hierarchical theorems, translation methods, P-NP problem, completeness problems, Turing reduction, interactive proof systems.

Intended learning outcomes

The students possess a fundamental and applicable knowledge in the areas of complexity measurements and classes, general relationships between space and time classes, memory consumption versus computation time, determinism versus indeterminism, hierarchical theorems, translation methods, P-NP problem, completeness problems, Turing reduction, interactive proof systems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Computer Science (2010)

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Computational Mathematics (2012)

Bachelor' degree (1 major) Computational Mathematics (2013)

Bachelor' degree (1 major) Aerospace Computer Science (2009)

Bachelor' degree (1 major) Aerospace Computer Science (2011)

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)



Master's degree (1 major) Computational Mathematics (2012)
First state examination for the teaching degree Gymnasium Computer Science (2009)



Module title					Abbreviation
Computer Architecture					10-I-RAK-102-m01
Module	coord	inator		Module offered by	
Dean o	f Studi	es Informatik (Computer :	Science) Institute of Computer Science		er Science
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
5	nume	rical grade			
Duration Module level Other p			Other prerequisites		
1 semester undergraduate		Admission prerequisite to assessment: exercises (type and scope to be			
			announced by the lecturer at the beginning of the course).		

Instruction set architectures, command processing through pipelining, statical and dynamic instruction scheduling, caches, vector processors, multi-core processors.

Intended learning outcomes

The students master the most important techniques to design fast computers as well as their interaction with compilers and operating systems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 69 (1) 1. c) Informatik Technische Informatik

Module appears in

Bachelor' degree (1 major) Computer Science (2010)

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Computational Mathematics (2012)

Bachelor' degree (1 major) Computational Mathematics (2013)

Bachelor' degree (1 major) Aerospace Computer Science (2009)

Bachelor' degree (1 major) Aerospace Computer Science (2011)

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)



Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Computational Mathematics (2012)



Module title				Abbreviation	
Computer Networks and Communication Systems					10-I-RK-102-m01
Module	e coord	inator		Module offered by	
holder	holder of the Chair of Computer Science III			Institute of Computer Science	
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites	3	
1 semester undergraduate		Admission prerequi	Admission prerequisite to assessment: exercises (type and scope to be		
			announced by the lecturer at the beginning of the course).		

Properties of computer and communication systems: data traffic in distributed systems. Performance analysis of computer networks and communication systems: problem statement and introduction to method architecture and structure of computer networks: network structure, network access, access methods, digital transfer hierarchies, dataflow control and traffic control, transfer network. Communication protocols: fundamental principles and ISO architecture models. Internet: structure and basic mechanism, TCP/IP, routing, network management. Mobile communication networks: fundamental concepts, GSM, UMTS. Future communication systems and networks.

Intended learning outcomes

The students possess an intricate knowledge of the structure of computer networks and communication systems as well as fundamental principles to rate these systems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Computer Science (2010)

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Computational Mathematics (2012)

Bachelor' degree (1 major) Computational Mathematics (2013)

Bachelor' degree (1 major) Aerospace Computer Science (2009)



Bachelor' degree (1 major) Aerospace Computer Science (2011)

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module	e title				Abbreviation
Knowle	edge-b	ased Systems			10-I-WBS-102-m01
Module coordinator				Module offered by	
holder	holder of the Chair of Computer Science VI			Institute of Computer Science	
ECTS	Meth	od of grading	Only after succ. co	mpl. of module(s)	
5	nume	rical grade			
Duration Module level Other prere		Other prerequisites	S		
1 seme	1 semester undergraduate				
Contents					

Foundations in the following areas: knowledge management systems, knowledge representation, solving methods, knowledge acquisition, learning, guidance dialogue, semantic web.

Intended learning outcomes

The students possess theoretical and practical knowledge for the understanding and design of knowledge-based systems including knowledge formalisation and have acquired experience in a small project.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 50 to 60 minutes)

if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Bachelor' degree (1 major) Computer Science (2010)

Bachelor' degree (1 major) Business Information Systems (2013)

Bachelor' degree (1 major) Aerospace Computer Science (2009)

Bachelor' degree (1 major) Aerospace Computer Science (2011)

Master's degree (1 major) Computer Science (2010)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Computational Mathematics (2012)



Module title				Abbreviation
Applied Analy	/sis			10-M=AAAN-102-m01
Module coord	linator		Module offered by	
Dean of Studi	es Mathematik (Mather	matics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 nume	rical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessment	r as announced by the ration deadlines. Ceresion to assessment (of exercises). The lector is at the beginning of sidered a declaration its have obtained the ecourse of the sement into effect. Studies assessment in the cures of the cures of the sement into effect.	nde via SB@home at the begin- ne lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a turer will inform students about of the course. Registration for the n of will to seek admission to as- e qualification for admission to ester, the lecturer will put their re- udents who meet all prerequisites urrent or in the subsequent seme- dents will have to obtain the qua- new.

In-depth study of functional analysis and operator theory, Sobolev spaces and partial differential equations, theory of Hilbert spaces and Fourier analysis, spectral theory and quantum mechanics, numerical methods (in particular FEM methods), principles of functional analysis, function spaces, embedding theorems, compactness, theory of elliptic, parabolic and hyperbolic partial differential equations with methods from functional analysis.

Recommended previous knowledge:

Familiarity with the contents of the module "Functional Analysis" is strongly recommended.

Intended learning outcomes

The student is acquainted with the fundamental notions, methods and results of higher analysis. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and questions in physics and other natural and engineering sciences.

Courses (type, number of weekly contact hours, language — if other than German)

 $V + \ddot{U}$ (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 54 / 220
	data record Master (120 ECTS) Mathematik - 2010	ĺ



Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Topics in Alge	ebra			10-M=AALG-102-m01
Module coord	linator		Module offered by	
Dean of Studi	es Mathematik (Mathe	matics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 nume	rical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessment	r as announced by the ration deadlines. Ceresion to assessment (of exercises). The lector is at the beginning of sidered a declaration its have obtained the ecourse of the sement into effect. Studies assessment in the cures of the cures of the sement into effect.	nde via SB@home at the begin- ne lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a turer will inform students about of the course. Registration for the n of will to seek admission to as- e qualification for admission to ester, the lecturer will put their re- udents who meet all prerequisites urrent or in the subsequent seme- dents will have to obtain the qua- new.

Contemporary topics in algebra, for example coding theory, elliptic curves, algebraic combinatorics or computer algebra.

Recommended previous knowledge:

Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".

Intended learning outcomes

The student is acquainted with fundamental concepts and methods in a contemporary field of algebra, and is able to apply these skills to complex questions.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places
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Additional information
Workload
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Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Differential G	eometry			10-M=ADGM-102-m01
Module coord	linator		Module offered by	
Dean of Studi	ies Mathematik (Mat	hematics)	Institute of Mather	natics
ECTS Meth	od of grading	Only after succ. co	mpl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites	5	
Duration 1 semester graduate Registration for the ning of the course of the specified regist to qualify for admis certain percentage the respective deta exercise will be consessment. If student assessment over the gistration for asses will be admitted to ster. For assessment		or as announced by the ration deadlines. Center is significant to assessment of exercises). The least the beginning of the series of the semination of the s	the lecturer in accordance with rtain prerequisites must be met (e. g. successful completion of a cturer will inform students about of the course. Registration for the n of will to seek admission to aste qualification for admission to ester, the lecturer will put their reudents who meet all prerequisites urrent or in the subsequent semedents will have to obtain the qua-	

Central and advanced results in differential geometry, in particular about differentiable and Riemannian manifolds.

Recommended previous knowledge:

Basic knowledge from the modules "Introduction to Differential Geometry", "Introduction to Topology" and "Geometric Analysis" is recommended.

Intended learning outcomes

The student is acquainted with concepts and methods for differentiable manifolds or Riemannian manifolds, is able to apply these methods and knows about the interaction of local and global methods in differential geometry

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Complex Ana	lysis			10-M=AFTH-102-m01
Module coord	linator		Module offered by	
Dean of Stud	ies Mathematik (Mathe	matics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites		
		ne lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a turer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their residents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quadrates.		

In-depth study of mapping properties of analytic functions and their generalisations with modern analytic and geometric methods. Structural properties of families of holomorphic and meromorphic functions. Special functions (e. g. elliptic functions).

Recommended previous knowledge:

Basic knowledge of the contents of the module "Introduction to Complex Analysis" is recommended.

Intended learning outcomes

The student is acquainted with the fundamental notions, methods and results of higher complex analysis, in particular the (geometric) mapping properties of holomorphic functions. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and applications in other subjects.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Language of assessment. German, English
Allocation of places
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Additional information
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Workload



Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Geometric S	itructures			10-M=AGMS-102-m01
Module coo	rdinator		Module offered by	,
Dean of Stu	dies Mathematik (Math	hematics)	Institute of Mathem	natics
ECTS Met	hod of grading	Only after succ. con	npl. of module(s)	
10 nun	nerical grade			
Duration	Module level	Other prerequisites	1	
Duration 1 semester graduate Registration for the ning of the course the specified regist to qualify for admist certain percentage the respective deta exercise will be consessment. If student assessment over the gistration for assess will be admitted to ster. For assessment		or as announced by the ration deadlines. Certain to assessment (of exercises). The least the beginning of sidered a declaration its have obtained the ecourse of the sement into effect. Strassessment in the cuassessment in the cuasses in the cuasing the c	the lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a sturer will inform students about of the course. Registration for the n of will to seek admission to aste qualification for admission to ester, the lecturer will put their redents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quadrate.	

Tits buildings, generalised polygons or related geometric structures, automorphisms, BN pairs in groups, Moufang conditions, classification results.

Recommended previous knowledge:

Basic knowledge from the modules "Introduction to Differential Geometry" and "Introduction to Topology" is recommended.

Intended learning outcomes

The student is acquainted with the fundamental notions, methods and results concerning a type of geometric structure. He/She is able to establish a connection between these results and broader theories, and learns about the interactions of geometry and other fields of mathematics.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

Allocation of places

Additional information

Teaching cycle

Workload

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 62 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Mathematical Physics (2012)



Module title	,			Abbreviation
Giovanni-Pro	di Lecture (Master)			10-M=AGPC-102-m01
Module coord	dinator		Module offered by	
Dean of Stud	ies Mathematik (Ma	thematics)	Institute of Mathem	atics
ECTS Meth	od of grading	Only after succ. co	mpl. of module(s)	
5 nume	erical grade			
Duration	Module level	Other prerequisites	S	
Semester graduate Registration for the ning of the course of the specified registration percentage of the respective detail exercise will be consessment. If student assessment over the gistration for assess will be admitted to a		or as announced by the ration deadlines. Cert is sion to assessment (or of exercises). The lect ils at the beginning of a sidered a declaration at shave obtained the semested into effect. Sturt assessment in the cunt at a later date, studing a side of the semested in the cunt at a later date, studing assessment in the cunt at a later date.	te lecturer in accordance with tain prerequisites must be met e.g. successful completion of a turer will inform students about if the course. Registration for the of will to seek admission to asqualification for admission to ster, the lecturer will put their redents who meet all prerequisites trent or in the subsequent sements will have to obtain the qua-	

Introduction to a specialised topic in mathematics by an international expert.

Intended learning outcomes

The student is acquainted with the fundamental concepts and methods of a contemporary research topic in mathematics. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and applications in other subjects.

 $\textbf{Courses} \ (\textbf{type}, \, \textbf{number of weekly contact hours, language} - \textbf{if other than German})$

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Language of assessment: English, German if agreed upon with the examiner

Allocation of places **Additional information** Workload **Teaching cycle**

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 64 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012) exchange program Mathematics (2023)



Module title			Abbreviation		
Industrial Statistics 1 Module coordinator			10-M=AIST-102-m01		
			Module offered by		
Dean of Stud	ies Mathematik (Mat	:hematics)	Institute of Mathematics		
ECTS Meth	od of grading	Only after succ. cor	Only after succ. compl. of module(s)		
10 num	erical grade				
Duration	Module level	Other prerequisites	S		
1 semester	graduate	ning of the course of the specified regist to qualify for admiss certain percentage the respective deta exercise will be consessment. If student assessment over the gistration for assess will be admitted to ster. For assessment	Other prerequisites Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisit will be admitted to assessment in the current or in the subsequent sem ster. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.		

Contonto

Theory of parameter and domain estimates, tests for statistical estimates, distribution models, empirical distribution analysis, comparative analysis, statistical product testing, survey sampling, audit sampling.

Intended learning outcomes

The student masters the fundamental statistical methods for industrial applications.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010)

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 66 / 220
	data record Master (120 ECTS) Mathematik - 2010	

Master's degree (1 major) Economathematics (2011)



Module title				Abbreviation
Lie Theory				10-M=ALTH-102-m01
Module coord	linator		Module offered by	
Dean of Studi	es Mathematik (Mather	natics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	Other prerequisites Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be more to qualify for admission to assessment (e.g., successful completion of certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for exercise will be considered a declaration of will to seek admission to sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put the gistration for assessment into effect. Students who meet all prerequiry will be admitted to assessment in the current or in the subsequent sets ster. For assessment at a later date, students will have to obtain the clification for admission to assessment anew.		ne lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a turer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their residents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quadrates.

Linear Lie groups and their Lie algebras, exponential function, structure and classification of Lie algebras, classic examples, applications, e. g. in physics and control theory.

Recommended previous knowledge:

Basic knowledge of the contents of the modules "Functional Analysis" and "Introduction to Topology" is recommended. Furthermore, basic knowledge of the contents of the module "Introduction to Differential Geometry" is useful.

Intended learning outcomes

The student is acquainted with the fundamental results, theorems and methods in Lie theory. He/She is able to apply these to common problems, and knows about the interactions of group theory, analysis, topology and linear algebra.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation	
Numeric of la	rge Systems of Equation	S		10-M=ANGG-102-m01	
Module coordinator			Module offered by		
Dean of Studi	es Mathematik (Mathem	natics)	Institute of Mathem	natics	
i i		Only after succ. con	Only after succ. compl. of module(s)		
10 nume	rical grade				
Duration	Module level	Other prerequisites			
1 semester	graduate	Other prerequisites Registration for the exercise must be made via SB@home at the bearing of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be to qualify for admission to assessment (e. g. successful completion certain percentage of exercises). The lecturer will inform students the respective details at the beginning of the course. Registration exercise will be considered a declaration of will to seek admission sessment. If students have obtained the qualification for admission assessment over the course of the semester, the lecturer will put the gistration for assessment into effect. Students who meet all prerequilible admitted to assessment in the current or in the subsequent ster. For assessment at a later date, students will have to obtain the lification for admission to assessment anew.		the lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a sturer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their resudents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quadrates.	

Discretisation of elliptic differential equations, classical iteration methods, preconditioners, multigrid methods.

Recommended previous knowledge:

Basic knowledge of numerical mathematics, such as that acquired in the modules "Numerical Mathematics 1" and "Numerical Mathematics 2", is required. Knowledge of the contents of the module "Basics in Optimization" is also recommended.

Intended learning outcomes

The student is acquainted with the most important methods for solving large systems of equations, and knows the most efficient way to solve a given system of equations.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

Allocation of places
Additional information
Workload
Teaching cycle



Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Basics of Optimization				10-M=AOPT-102-m01
Module coord	linator		Module offered by	
Dean of Stud	ies Mathematik (Math	ematics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites	r prerequisites	
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a	Registration for the exercise must be made via SB@home at the begin ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be me to qualify for admission to assessment (e. g. successful completion of certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to a sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their gistration for assessment into effect. Students who meet all prerequisity will be admitted to assessment in the current or in the subsequent services. For assessment at a later date, students will have to obtain the qualification for a decision to exercise will have to obtain the qualification for an admission to a service will be admitted to assessment in the current or in the subsequent service.	

Fundamental methods and techniques in continuous optimization, unrestricted optimization, conditions for optimality, restricted optimization, examples and applications in natural and engineering sciences as well as economics.

Intended learning outcomes

The student knows the fundamental methods of continous optimization, can judge their strengths and weaknesses and can decide which method is the most suitable in applications.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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	data record Master (120 ECTS) Mathematik - 2010	



Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Introduction	to Control Theory			10-M=ARTH-102-m01
Module coord	dinator		Module offered by	•
Dean of Stud	ies Mathematik (Math	ematics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites	i e	
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessment	or as announced by the ration deadlines. Ceresion to assessment (of exercises). The least the beginning of the series have obtained the ecourse of the sement into effect. Strassessment in the cuassessment in the cuasses in the cuasing	de via SB@home at the beginhe lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a sturer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their redents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quanew.

Introduction to mathematical systems theory: stability, controllability and observability, state feedback and stability, basics in optimal control.

Recommended previous knowledge:

Basic knowledge of the contents of the module "Ordinary Differential Equations" is useful.

Intended learning outcomes

The student is acquainted with the fundamental notions and methods of control theory. He/She is able to establish a connection between these results and broader theories, and learns about the interactions of geometry and other fields of mathematics.

Courses (type, number of weekly contact hours, language — if other than German)

 $V + \ddot{U}$ (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 90 to 120 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German or English

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Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Aerospace Computer Science (2009)

Bachelor' degree (1 major) Aerospace Computer Science (2011)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module titl	e			Abbreviation
Stochastic	Models for Risk Analys	sis		10-M=ASMR-102-m01
Module cod	ordinator		Module offered by	
Dean of Stu	dies Mathematik (Mat	hematics)	Institute of Mathen	natics
ECTS Me	thod of grading	Only after succ. co	mpl. of module(s)	
10 nui	nerical grade			
Duration	Module level	Other prerequisites	5	
1 semester	graduate	ning of the course of the specified regist to qualify for admiss certain percentage the respective deta exercise will be con- sessment. If studen assessment over the gistration for asses will be admitted to ster. For assessment	or as announced by the ration deadlines. Certains to assessment of exercises). The least last the beginning considered a declaration of the sement into effect. Strassessment in the coassessment in the coass	ade via SB@home at the beginhe lecturer in accordance with rtain prerequisites must be met (e. g. successful completion of a cturer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their redents who meet all prerequisites current or in the subsequent semedents will have to obtain the quanchew.

Measure theory, risk diagrams, failure mode and effects analysis, risk assessment in auditing, shortfall measures, value at risk, conditional value at risk, axiomatic of risk measures, modelling of interdependencies, copula, modelling of functional interrelations, regression models, basics in time series modelling, aggregated losses, estimates of shortfall measures, estimates of value at risk and conditional value at risk, basics in empirical time series analysis, methods of exponential smoothing, predictions and prediction domains, estimates of value at risk in time series, elementary empirical regression analysis, simulation methods.

Intended learning outcomes

The student is acquainted with the fundamental methods of stochastic risk analysis.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 76 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



Module title				Abbreviation
Stochastica	Processes		-	10-M=ASTP-102-m01
Module coor	dinator		Module offered by	,
Dean of Stud	lies Mathematik (Math	nematics)	Institute of Mathem	natics
ECTS Met	hod of grading	Only after succ. con	npl. of module(s)	
10 num	erical grade			
Duration	Module level	Other prerequisites	;	
1 semester	graduate	ning of the course of the specified registr to qualify for admis certain percentage of the respective detail exercise will be con- sessment. If studen assessment over the gistration for assess will be admitted to ster. For assessment	or as announced by the ration deadlines. Certains to assessment (of exercises). The least the beginning of sidered a declaration its have obtained the ecourse of the sement into effect. Strassessment in the cursessment in the curses.	nde via SB@home at the begin- the lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a cturer will inform students about of the course. Registration for the en of will to seek admission to as- e qualification for admission to ester, the lecturer will put their re- udents who meet all prerequisites urrent or in the subsequent seme- dents will have to obtain the qua- new.

Markov chains, queues, stochastic processes in C[0,1], Brownian motion, Donsker's theorem, projective limits.

Recommended previous knowledge:

Basic knowledge of stochastics is required, such as that acquired in the "Stochastics 1" module. Knowledge of the contents of the module "Stochastics 2" is also recommended.

Intended learning outcomes

The student is acquainted with the fundamental notions and methods of stochastical processes and can apply them to practical problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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	data record Master (120 ECTS) Mathematik - 2010	



Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title	<u> </u>		Abbreviation	
Topology			10-M=ATOP-102-m01	
Module coo	rdinator		Module offered by	
Dean of Stu	dies Mathematik (Ma	thematics)	Institute of Mathematics	
ECTS Met	hod of grading	Only after succ. cor	mpl. of module(s)	
10 num	nerical grade			
Duration	Module level	Other prerequisites	s	
1 semester	graduate	ning of the course of the specified regist to qualify for admiss certain percentage the respective deta exercise will be con- sessment. If studer assessment over the gistration for asses will be admitted to ster. For assessmer	Registration for the exercise must be made via SB@home at the begin ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be me to qualify for admission to assessment (e. g. successful completion of certain percentage of exercises). The lecturer will inform students abo the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their gistration for assessment into effect. Students who meet all prerequis will be admitted to assessment in the current or in the subsequent sets ster. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.	

Set-theoretic topology, topological invariants (e. g. fundamental group, connection), construction of topological spaces, covering spaces.

Intended learning outcomes

The student is acquainted with the fundamental results, theorems and methods in topology and is able to apply these to common problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 80 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Insurance Ma	thematics			10-M=AVSM-102-m01
Module coord	linator		Module offered by	
Dean of Stud	ies Mathematik (Mat	hematics)	Institute of Mathen	natics
ECTS Meth	od of grading	Only after succ. cor	npl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites	3	
1 semester	graduate	ning of the course of the specified regist to qualify for admis certain percentage the respective deta exercise will be con sessment. If studen assessment over th gistration for asses will be admitted to ster. For assessmen	or as announced by the ration deadlines. Center is significant to assessment of exercises). The least the beginning of the series have obtained the ecourse of the sement into effect. Strassessment in the coassessment in the co	ade via SB@home at the beginhe lecturer in accordance with rtain prerequisites must be met (e. g. successful completion of a cturer will inform students about of the course. Registration for the n of will to seek admission to aste qualification for admission to ester, the lecturer will put their redents who meet all prerequisites current or in the subsequent semedents will have to obtain the quantew.

The module discusses policies on one life: distributions of future lifetime, life tables, life table approximations, types of benefits, present value, expection principle, premium calculation, commutation functions, reserves and policy values, expenses, bonus, recursive methods, Thiele's differential equation.

Recommended previous knowledge:

Depending on the content, basic and advanced knowledge from different areas of statistics or stochastics is required. In case of doubt, it is recommended to consult the lecturer.

Intended learning outcomes

The student is acquainted with the fundamental notions and methods of life insurance mathematics and can apply them to practical problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places	
Additional information	
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Workload	



Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Economathematics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



Module title	•			Abbreviation
Time Series	Analysis 1			10-M=AZRA-102-m01
Module coo	rdinator		Module offered by	
Dean of Stu	dies Mathematik (Matl	hematics)	Institute of Mathem	natics
ECTS Met	hod of grading	Only after succ. con	npl. of module(s)	
10 nun	nerical grade			
Duration	Module level	Other prerequisites	.	
1 semester	graduate	ning of the course of the specified registre to qualify for admiss certain percentage of the respective detail exercise will be con- sessment. If studen assessment over the gistration for assess will be admitted to ster. For assessment	or as announced by the ration deadlines. Cer sion to assessment (of exercises). The lectils at the beginning of sidered a declaration its have obtained the e course of the sement into effect. Stuassessment in the cu	de via SB@home at the beginne lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a sturer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their resudents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quanew.

Additive model, linear filters, autocorrelation, moving average, autoregressive processes, Box-Jenkins method.

Recommended previous knowledge:

Basic knowledge of stochastics is required, such as that acquired in the "Stochastics 1" module. Knowledge of the contents of the module "Stochastics 2" is also recommended.

Intended learning outcomes

The student is acquainted with the fundamental methods of time series analysis and can apply them to practical problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 84 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



Module title				Abbreviation
Number Theo	ry			10-M=AZTH-102-m01
Module coord	linator		Module offered by	
Dean of Studi	es Mathematik (Mather	natics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 nume	rical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consistent. If student assessment over the gistration for assess will be admitted to a	r as announced by the ration deadlines. Ceresion to assessment (of exercises). The lect is at the beginning of sidered a declaration its have obtained the ecourse of the sement into effect. Studies assessment in the cut at a later date, studies.	de via SB@home at the beginne lecturer in accordance with tain prerequisites must be met e.g. successful completion of a turer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their residents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quanew.

Number-theoretic functions and their associated Dirichlet series resp. Euler products, their analytic theory with applications to prime number distribution and diophantine equations; discussion of the Riemann hypothesis, overview of the development of modern number theory.

Recommended previous knowledge:

Basic knowledge of algebra and number theory is assumed, such as can be acquired in the modules "Introduction to Algebra", "Introduction to Number Theory" and "Applied Algebra".

Intended learning outcomes

The student is acquainted with the fundamental methods of analytics number theory, can deal with algebraic structures in number theory and knows methods for the solution of diophantine equations. He/She has insight into modern developments in number theory.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 86 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Modul	Module title Abbreviation					
Learni	ng by te	eaching Mathematics 1			10-M=ELT1-102-m01	
Modul	e coord	inator		Module offered by		
Dean c	of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS		od of grading	Only after succ. com			
5	nume	rical grade		•		
Duratio	on	Module level	Other prerequisites			
1 seme	ester	graduate				
Conter	nts					
Superv	ising a	tutorial or study group in	the Bachelor's progr	amme under guidan	ce of the respective lecturer.	
Intend	ed lear	ning outcomes				
		ains his/her first experier can apply them in practic		rsity mathematics. H	le/She knows basic didactical	
Course	es (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
Ü (no i	nforma	tion on SWS (weekly cont	act hours) and cours	e language available	e)	
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-	
		nination (approx. 90 minu ssessment: German, Eng				
Allocat	tion of	olaces				
Additio	onal inf	ormation				
Worklo	oad					
Teachi	ing cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master	Master's degree (1 major) Mathematics (2012)					
	_	ee (1 major) Mathematics				
Master	Master's degree (1 major) Mathematical Physics (2012)					



Module	Module title Abbreviation					
Learnii	ng by T	eaching 2			10-M=ELT2-102-m01	
Module	e coord	inator		Module offered by		
		es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS		od of grading	Only after succ. con		Tatres	
5		rical grade		, , ,		
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	its					
Superv	ising a	tutorial or study group in	the Bachelor's progr	ramme under guidar	ice of the respective lecturer.	
Intend	ed lear	ning outcomes				
	_	ains his/her first experie can apply them in practio	_	rsity mathematics. F	He/She knows basic didactical	
Course	s (type	, number of weekly conta	ict hours, language –	- if other than Germa	an)	
Ü (no iı	nforma	tion on SWS (weekly con	tact hours) and cours	e language availabl	e)	
		sessment (type, scope, la ion on whether module c			ation offered — if not every seme-	
		nination (approx. 90 min Issessment: German, Eng	-			
Allocat	ion of	places				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in					
	Master's degree (1 major) Mathematics (2012)					
Master	Master's degree (1 major) Mathematics (2010)					



Module title					Abbreviation	
Interns	ship (La	b Course) Applied Mathe		10-M=EPRK-102-m01		
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	ipl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	•		om the Institute of Mathematics or she will register the student for	
Conten	its					
Work p	laceme	ent in economy, industry,	research or administ	ration.		
Intende	ed lear	ning outcomes				
		pplies his/her skills obta research, economy or in	_	tudies in the master	programme to a specific practi-	
Course	s (type	, number of weekly conta	ct hours, language –	if other than Germa	ın)	
P (no ir	nformat	tion on SWS (weekly cont	act hours) and cours	e language available	<u>e</u>)	
		sessment (type, scope, la ion on whether module ca			ition offered — if not every seme-	
port on	ı techni	oort / fieldwork report / re cal course (oral: approx. ssessment: German, Eng	30 to 60 minutes, wr		ctical course / project report / re- 30 pages)	
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in					
	Master's degree (1 major) Mathematics (2012)					
Master	Master's degree (1 major) Mathematics (2010)					



Module title				Abbreviation	
Study Group Algebra				_	10-M=GALG-102-m01
Module	coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Math	nematics)	Institute of Mathem	natics
ECTS	Meth	od of grading	Only after succ. co	mpl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisite	S	
1 semester graduate Registration for the seminar must be made via SB@home at ning of the course or as announced by the lecturer in accord specified registration deadlines. Some seminars or workshown by be open for students with previous knowledge and/or ski areas. Where applicable, details will be specified in the class		he lecturer in accordance with the seminars or workshops might on- lowledge and/or skills in certain			

Selected modern topics in algebra (e. g. ring theory, commutative algebra, differential algebra, local fields, computer algebra, algebras, division rings, quadratic forms).

Recommended previous knowledge:

Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".

Intended learning outcomes

The student gains insight into contemporary research problems in algebra. He/She masters advanced techniques in this field and can apply them to complex problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 120 minutes, c) written examination (approx. 90 to 120 minutes), d) oral examination of one candidate each (approx. 20 minutes), e) oral examination in groups (groups of 2, approx. 30 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 91 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Module title					Abbreviation	
Study	Study Group Discrete Mathematics				10-M=GDIM-102-m01	
Modul	e coord	inator		Module offered by		
		es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS		od of grading	Only after succ. com		natics	
10		rical grade		ipu oi modute(s)		
Duratio		Module level	Other prerequisites			
1 seme	ester	graduate	ning of the course o specified registratio ly be open for stude	r as announced by the n deadlines. Some s nts with previous kn	nde via SB@home at the beginhe lecturer in accordance with the seminars or workshops might onnowledge and/or skills in certain specified in the class schedule.	
Conter	nts					
Selecte	ed mod	ern topics in discrete ma	thematics.			
Intend	ed lear	ning outcomes				
		ains insight into contempes in this field and can ap			hematics. He/She masters advan	
Course	es (type	, number of weekly conta	ct hours, language —	· if other than Germa	an)	
V + S (no infor	mation on SWS (weekly	contact hours) and co	urse language avail	able)	
		sessment (type, scope, la on on whether module c			ation offered — if not every seme-	
minar sentat of one	present ion of a candid	ation (approx. 60 to 120 pprox. 60 to 120 minutes	minutes), b) written e , c) written examinati utes), e) oral examina	laboration of conter on (approx. 90 to 12	ng methods of assessment: a) sents equivalent to a seminar pre- zo minutes), d) oral examination ups of 2, approx. 30 minutes)	
	tion of p					
Additio	onal inf	ormation				
Worklo	oad					
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
	Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010)					



Module title Abbreviation						
Study Group Dynamical Systems and Control					10-M=GDSR-102-m01	
Modul	e coord	inator		Module offered by	<u>I</u>	
Dean o	f Studi	es Mathematik (Mat	hematics)	Institute of Mathen	natics	
ECTS	Meth	od of grading	Only after succ. cor	mpl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites	Other prerequisites		
1 seme	ester	graduate	ning of the course of specified registration ly be open for students.	Registration for the seminar must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might only be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule.		
Contents						
Selected modern topics in dynamical systems and control theory.						

Recommended previous knowledge:

Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required.

Intended learning outcomes

The student gains insight into contemporary research problems in dynamical systems and control theory. He/ She masters advanced techniques in this field and can apply them to complex problems.

Courses (type, number of weekly contact hours, language - if other than German)

V + S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 120 minutes, c) written examination (approx. 90 to 120 minutes), d) oral examination of one candidate each (approx. 20 minutes), e) oral examination in groups (groups of 2, approx. 30 minutes) Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



Modul	e title					Abbreviation
Study	Group (Complex Analysis				10-M=GFTH-102-m01
Modul	e coord	inator			Module offered by	
Dean c	f Studi	es Mathematik (Mat	thematics)		Institute of Mather	natics
ECTS	Meth	od of grading	Only after s	ucc. con	npl. of module(s)	
10	nume	rical grade				
Duratio	on	Module level	Other prered	quisites		
1 seme	ster	graduate	Registration	for the	seminar must be ma	ade via SB@home at the begin-
			ning of the c	course o	r as announced by t	the lecturer in accordance with the
			specified reg	gistratio	n deadlines. Some	seminars or workshops might on-
			ly be open fo	or stude	nts with previous k	nowledge and/or skills in certain
			areas. Wher	e applic	able, details will be	specified in the class schedule.
Conter	its					
Selecte	ed mod	ern topics in compl	ex analysis (e. g. in	approx	imation theory, pot	ential theory, complex dynamics,
geome	tric cor	nplex analysis, valu	e distribution theo	ry).		
Dogom	m a n d a	ط معمدا مدد الممددا مط	~ 0.			
		d previous knowled		ıladga fr	om different areas o	of analysis is required. Consultati-
		cturer at the beginn				or unatysis is required. Consultati
		ning outcomes				
The stu	ıdent g	ains insight into cor	ntemporary researd	h probl	ems in complex ana	alysis. He/She masters advanced
	_	this field and can a		•	•	<u> </u>
Course	s (type	, number of weekly	contact hours, lang	guage –	- if other than Germa	an)
V + S (1	no infoi	rmation on SWS (we	ekly contact hours	and co	ourse language avai	lable)
Metho	d of ass	sessment (type, sco	pe, language — if o	other th	an German, examina	ation offered — if not every seme-
ster, information on whether module can be chosen to earn a bonus)						
At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) se-						
minar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar pre-						
sentation of approx. 60 to 120 minutes, c) written examination (approx. 90 to 120 minutes), d) oral examination						
	of one candidate each (approx. 20 minutes), e) oral examination in groups (groups of 2, approx. 30 minutes) Language of assessment: German, English					
of one				CAMIIIII	ation in gloups (glo	ups of 2, approx. 30 illiliates)
of one Langua		ssessment: Germar		examin		αρό οι 2, αρρίολ. 30 illiliates)

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)



Module title					Abbreviation		
Study	Study Group Geometry and Topology				10-M=GGMT-102-m01		
Module	Module coordinator			Module offered by			
Dean o	f Studi	es Mathematik (Mathen	natics)	Institute of Mathem	natics		
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)			
10	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ester	graduate	ning of the course o specified registrationally be open for stude	Registration for the seminar must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might only be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule.			
Conten	ıts						
Selecte	ed mod	ern topics in geometry a	and topology.				
Intend	ed lear	ning outcomes					
		ains insight into contemiques in this field and ca			d topology. He/She masters ad-		
Course	s (type	, number of weekly cont	tact hours, language –	- if other than Germa	an)		
V + S (1	no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)		
		sessment (type, scope, ion on whether module			ation offered — if not every seme-		
minar p sentati of one	present ion of a candid	tation (approx. 60 to 120 pprox. 60 to 120	o minutes), b) written e es, c) written examinat inutes), e) oral examin	elaboration of conter ion (approx. 90 to 12	ng methods of assessment: a) sents equivalent to a seminar pre- zo minutes), d) oral examination ups of 2, approx. 30 minutes)		
Allocat	tion of p	places					
Additio	onal inf	ormation					
Worklo	oad						
Teachi	Teaching cycle						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in						
Master	Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010)						



Module title					Abbreviation
Study	Group I	Mathematics in its Conte	ext		10-M=GMKX-102-m01
Modu	Module coordinator			Module offered by	
Dean	of Studi	es Mathematik (Mathem	atics)	Institute of Mathen	 natics
ECTS		od of grading	Only after succ. com		
10		rical grade			
Durati	ion	Module level	Other prerequisites		
1 sem	ester	graduate	ning of the course o specified registratio ly be open for stude	r as announced by t n deadlines. Some : nts with previous kr	ade via SB@home at the beginhe lecturer in accordance with the seminars or workshops might on-nowledge and/or skills in certain specified in the class schedule.
Conte	ntc	<u> </u>	areas. Where applie	abie, details will be	specifica in the class seriedate.
ven by the co	y a histo onnectio	rical period, a geograph n of mathematics with li	ic region or a particula	ar field of mathemat	of the history of mathematics, gi- ics. Other possibilities arise from a.
		ning outcomes			
	_	ealises the cultural dime			
Cours	es (type	, number of weekly cont	act hours, language –	- if other than Germa	an)
V + S	(no info	rmation on SWS (weekly	contact hours) and co	urse language avail	lable)
		sessment (type, scope, loon on whether module o			ation offered — if not every seme-
minar sentat of one	present tion of a candid	ration (approx. 60 to 120 pprox. 60 to 120	minutes), b) written e s, c) written examinat nutes), e) oral examin	elaboration of conte ion (approx. 90 to 12	ng methods of assessment: a) sents equivalent to a seminar prezo minutes), d) oral examination ups of 2, approx. 30 minutes)
Alloca	ation of	places			
Additi	ional inf	ormation			
Workload					
Teaching cycle					
Referr	red to in	LPO I (examination regi	ulations for teaching-o	degree programmes	
Modu	le appea	ars in			
	, ,				

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010)



Module	e title				Abbreviation
Study	Group I	Measure and Integra	l		10-M=GMUI-102-m01
Modul	e coord	linator		Module offered by	
Dean o	f Studi	es Mathematik (Matl	nematics)	Institute of Mathem	natics
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme		graduate	ning of the course of specified registration ly be open for stude	or as announced by the on deadlines. Some s onts with previous kn	ide via SB@home at the begin- he lecturer in accordance with the seminars or workshops might on- lowledge and/or skills in certain specified in the class schedule.
Conten	its				
functio	ns and	Lebesgue integrals,	, , ,	g. product measures	me and measure, measurable s (with Fubini's theorem and the cal spaces.

Intended learning outcomes

The student gains insight into contemporary research problems in measure and integration theory. He/She masters advanced techniques in this field and can apply them to complex problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 120 minutes, c) written examination (approx. 90 to 120 minutes), d) oral examination of one candidate each (approx. 20 minutes), e) oral examination in groups (groups of 2, approx. 30 minutes) Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



Modul	e title				Abbreviation
Study	Group I	Numerical Mathematics	and Applied Analysis	•	10-M=GNMA-102-m01
Modul	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathem	natics)	Institute of Mathem	natics
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites	i	
1 seme	ester	graduate	ning of the course of specified registrations by be open for students.	r as announced by the on deadlines. Some s onts with previous kn	de via SB@home at the beginhe lecturer in accordance with the seminars or workshops might onwledge and/or skills in certain specified in the class schedule.
Conten	nte		•		

Selected topics in numerical mathematics, applied analysis or scientific computing.

Recommended previous knowledge:

Depending on the content, basic and advanced knowledge from different areas of analysis and/or numerical mathematics is required. In case of doubt, it is recommended to consult the lecturer.

Intended learning outcomes

The student gains insight into a contemporary research problems in numerical mathematics or applied analysis. He/She masters advanced techniques in this field and can apply them to complex problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 120 minutes, c) written examination (approx. 90 to 120 minutes), d) oral examination of one candidate each (approx. 20 minutes), e) oral examination in groups (groups of 2, approx. 30 minutes) Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Study Group Robotic, Optimization and Control Theory Another Studies Mathematik (Mathematics) Institute of Mathematics	Modul					Abbreviation
Dean of Studies Mathematik (Mathematics) ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade Other prerequisites 1 semester graduate Registration for the seminar must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might only be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule. Contents Selected modern topics in robotics, optimisation and control theory. Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)	Study	Group I	Robotic, Optimization a	nd Control Theory		10-M=GROK-102-m01
Contents Selected modern topics in robotics, optimisation and control Theory.	Modul	e coord	linator		Module offered by	
Duration Module level Other prerequisites 1 semester graduate Registration for the seminar must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might only be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule. Contents Selected modern topics in robotics, optimisation and control theory. Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)	Dean c	f Studi	es Mathematik (Mathen	natics)	Institute of Mather	matics
Duration Module level Prerequisites 1 semester Product Present Product Presenting of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might only be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule. Contents Selected modern topics in robotics, optimisation and control theory. Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)	ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)	
Registration for the seminar must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might only be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule. Contents Selected modern topics in robotics, optimisation and control theory. Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)	10	nume	rical grade			
ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might only be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule. Contents Selected modern topics in robotics, optimisation and control theory. Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)	Duratio	on	Module level	Other prerequisites	;	
specified registration deadlines. Some seminars or workshops might only be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule. Contents Selected modern topics in robotics, optimisation and control theory. Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)	1 seme	ster	graduate	Registration for the	seminar must be ma	ade via SB@home at the begin-
ly be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule. Contents Selected modern topics in robotics, optimisation and control theory. Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)				ning of the course of	r as announced by t	the lecturer in accordance with the
Contents Selected modern topics in robotics, optimisation and control theory. Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)				specified registration deadlines. Some seminars or workshops might on-		
Contents Selected modern topics in robotics, optimisation and control theory. Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)				1''	•	
Selected modern topics in robotics, optimisation and control theory. Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)				areas. Where applic	able, details will be	specified in the class schedule.
Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)	Conter	ıts				
Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)	Selecte	ed mod	ern topics in robotics, o	ptimisation and contr	ol theory.	
Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required. Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)						
Intended learning outcomes The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)					t	ortical Theorem III is no socious d
The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)				<u>luie mathematical Co</u>	ontrol ineory or Co	introl meory is required.
She masters advanced techniques in this field and can apply them to complex problems. Courses (type, number of weekly contact hours, language — if other than German)						
Courses (type, number of weekly contact hours, language — if other than German)						
			•		•	,
V + S (no information on SWS (weekly contact hours) and course language available)						
	V + S (ı	no info	rmation on SWS (weekly	contact hours) and co	ourse language avai	lable)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 120 minutes, c) written examination (approx. 90 to 120 minutes), d) oral examination of one candidate each (approx. 20 minutes), e) oral examination in groups (groups of 2, approx. 30 minutes) Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Modul	e title				Abbreviation
Study	Group S	Statistics			10-M=GSTA-102-m01
Modul	e coord	linator		Module offered by	
Dean o	f Studi	es Mathematik (Mat	hematics)	Institute of Mathen	natics
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites	•	
1 seme	ester	graduate	ning of the course of specified registration ly be open for stude	or as announced by t on deadlines. Some s ents with previous kr	nde via SB@home at the begin- he lecturer in accordance with the seminars or workshops might on- nowledge and/or skills in certain specified in the class schedule.
Conten	ıts				
Selecte	ed mod	ern topics in statisti	CS.		
Recom	mende	d previous knowleds	ge:		

Basic knowledge of stochastics is required, such as that acquired in the "Stochastics 1" module. Knowledge of the contents of the module "Stochastics 2" is also recommended. Depending on the content of the course, other prior knowledge may also be helpful; consultation with the lecturer is recommended.

Intended learning outcomes

The student gains insight into contemporary research problems in statistics. He/She masters advanced techniques in this field and can apply them to complex problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 120 minutes, c) written examination (approx. 90 to 120 minutes), d) oral examination of one candidate each (approx. 20 minutes), e) oral examination in groups (groups of 2, approx. 30 minutes) Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



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Modul		Fi C A I i.			Abbreviation
Study	Group	Time Series Analysis	;		10-M=GZRA-102-m01
Modul	e coord	inator		Module offered by	y
Dean c	f Studi	es Mathematik (Mat	hematics)	Institute of Mathe	ematics
ECTS	Meth	od of grading	Only after succ. co	mpl. of module(s)	
10	nume	rical grade			
Duration	on	Module level	Other prerequisite	S	
1 seme	ester	graduate	ning of the course specified registrati ly be open for stud	or as announced by on deadlines. Some ents with previous k	nade via SB@home at the begin- the lecturer in accordance with the e seminars or workshops might on- knowledge and/or skills in certain e specified in the class schedule.
Conter	nts			·	'
Basic l the co	nowled ntents o	of the module "Stoch			hastics 1" module. Knowledge of
		ning outcomes			
	_	•	temporary research prob an apply them to comple		analysis. He/She masters advan-
Course	es (type	, number of weekly	contact hours, language	— if other than Germ	nan)
V + S (no info	rmation on SWS (we	ekly contact hours) and o	ourse language ava	ilable)
			pe, language — if other tl ule can be chosen to ear		nation offered — if not every seme-
minar sentat of one	present ion of a candid	ation (approx. 60 to pprox. 60 to	120 minutes), b) written nutes, c) written examina o minutes), e) oral exami	elaboration of conti	ving methods of assessment: a) seents equivalent to a seminar pre- 120 minutes), d) oral examination oups of 2, approx. 30 minutes)
Alloca	tion of _I	places			
۸ ما ما:د:		ormation			

Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



Module	e title				Abbreviation
Study	Group I	Number Theory			10-M=GZTH-102-m01
Module	e coord	linator		Module offered	l by
Dean o	f Studi	es Mathematik (Math	ematics)	Institute of Mat	hematics
ECTS	Meth	od of grading	Only after succ. co	mpl. of module(s)
10	nume	rical grade			
Duratio	n	Module level	Other prerequisite	es	
Recom	ed mod	d previous knowledg	ning of the course specified registrat ly be open for stud areas. Where appl theory (e. g. algebraic i	or as announced ion deadlines. So lents with previou icable, details wil	e made via SB@home at the begin- by the lecturer in accordance with the me seminars or workshops might on as knowledge and/or skills in certain a be specified in the class schedule. Odular forms, diophantine analysis).
			mber Theory" and "App	lied Algebra".	
		ning outcomes	omporant receased as a	olome in numer th	eory. He/She masters advanced tech
	_	_	hem to complex proble		eory. He/ Site masters advanced tech
Course	s (type	, number of weekly c	ontact hours, language	— if other than Ge	erman)
V + S (r	no info	rmation on SWS (wee	kly contact hours) and	course language a	available)
			e, language — if other t le can be chosen to ea		mination offered — if not every seme-
At the l	beginn	ing of the course, the	lecturer will choose on	e or two of the foll	lowing methods of assessment: a) sontents equivalent to a seminar pre

sentation of approx. 60 to 120 minutes, c) written examination (approx. 90 to 120 minutes), d) oral examination of one candidate each (approx. 20 minutes), e) oral examination in groups (groups of 2, approx. 30 minutes) Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)



Modul	e title				Abbreviation
Maste	Thesis	Mathematics			10-M=MAAR-102-m01
Module	e coord	inator		Module offered by	
		es Mathematik (Mathem	atics)	Institute of Mathem	natics
ECTS		od of grading	Only after succ. com		idites
30		rical grade		.pu or modulo(o)	
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate	' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' 	essment and assignr	ment of topic in consultation with
			supervisor. The supe	ervisor may make the	e successful completion of cer-
			tain modules that ar	e relevant for the res	spective topic a prerequisite for
			the assignment of th	ne topic.	
Conter	its				
Indepe	ndentl	y researching and writing	on a topic in mathem	natics selected in co	nsultation with the supervisor.
Intend	ed lear	ning outcomes			
tained					oply the skills and methods ob- the result of his/her work in a
Course	s (type	, number of weekly conta	act hours, language –	if other than Germa	ın)
no cou	rses as	signed			
		sessment (type, scope, la ion on whether module c			tion offered — if not every seme-
written Langua		ssessment: German, Eng	glish		
Allocat	ion of	olaces			
Additio	nal inf	ormation	-		
Worklo	ad				
Teachi	ng cycl	e			
Referre	ed to in	LPO I (examination regu	ulations for teaching-c	legree programmes)	
Modul	e appea	ars in			
		ee (1 major) Mathematic	s (2012)		
	_	ee (1 major) Mathematic			



Module	e title				Abbreviation	
Semina	ar in Ap	plied Differential G	eometry		10-M=SADG-102-m01	
Module	e coord	inator		Module offer	ed by	
Dean o	f Studi	es Mathematik (Mat	hematics)	Institute of M	athematics	
ECTS	Meth	od of grading	Only after succ	Only after succ. compl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequis	sites		
1 seme	ster	graduate	ning of the cour specified regist ly be open for s	rse or as announce ration deadlines. S tudents with previo	be made via SB@home at the beginded by the lecturer in accordance with the some seminars or workshops might onbus knowledge and/or skills in certain will be specified in the class schedule.	

A modern topic in applied differential geometry.

Recommended previous knowledge:

Advanced knowledge of differential geometry is required, such as can be acquired in the module "Differential Geometry". Knowledge of the contents of the modules "Applied Differential Geometry", "Geometric Mechanics", "Pseudo-Riemannian and Riemannian Geometry" and "Lie Theory" is also recommended.

Intended learning outcomes

The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.

Courses (type, number of weekly contact hours, language — if other than German)

S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 90 minutes

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)



Module	e title				Abbreviation	
Semina	ar in Al	gebra			10-M=SALG-102-m01	
Module	e coord	linator		Module offered by	<u> </u>	
Dean o	f Studi	es Mathematik (Ma	thematics)	Institute of Mathen	natics	
ECTS	Meth	od of grading	Only after succ. co	ompl. of module(s)		
5	nume	erical grade				
Duratio	n	Module level	Other prerequisite	Other prerequisites		
1 seme	ster	graduate	ning of the course specified registrat ly be open for stud	or as announced by t ion deadlines. Some s dents with previous kr	de via SB@home at the begin- he lecturer in accordance with the seminars or workshops might on- lowledge and/or skills in certain specified in the class schedule.	
Conten	its		,			

A modern topic in algebra.

Recommended previous knowledge:

Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".

Intended learning outcomes

The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.

Courses (type, number of weekly contact hours, language - if other than German)

S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 90 minutes

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)



Module tit	le			Abbreviation
Seminar in	Dynamical Systems ar	nd Control		10-M=SDSR-102-m01
Module co	ordinator		Module offered by	
Dean of St	udies Mathematik (Mat	hematics)	Institute of Mathem	natics
	thod of grading	Only after succ. co	mpl. of module(s)	
5 nu	merical grade			
Duration	Module level	Other prerequisite		
1 semester	graduate			de via SB@home at the begin-
		I -	•	he lecturer in accordance with the
		, ·		seminars or workshops might on-
		1 '	•	owledge and/or skills in certain
		areas. Where appli	icable, details will be	specified in the class schedule.
Contents				
A modern t	opic in dynamical syste	ems and control.		
	ded previous knowledge of the contents of the		ontrol Theory" or "Co	ntrol Theory" is required.
المحاميا	earning outcomes			
intended le	t is able to elaborate a	contemporary research t	topic. This includes co	omprehending and structuring of
The studen		ire, preparing a talk and	•	ate in a scientific discussion.
The studen	nd the available literatu	ure, preparing a talk and contact hours, language	the ability to participa	ate in a scientific discussion.
The studer the topic a Courses (ty	nd the available literature, number of weekly o		the ability to participate. — if other than Germa	ate in a scientific discussion.
The studer the topic a Courses (ty S (no informatth of Method of	nd the available literature, number of weekly of mation on SWS (weekly assessment (type, sco	contact hours, language contact hours) and cour	the ability to participate of the ability to participate of the control of the co	ate in a scientific discussion.

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



Module coo	Complex Analysis rdinator dies Mathematik (Math		Module offered by	10-M=SFTH-102-m01	
			Module offered by		
Dean of Stu	dies Mathematik (Math				
		nematics)	Institute of Mathen	natics	
ECTS Met	hod of grading	Only after succ. co	mpl. of module(s)		
5 num	nerical grade				
Duration	Module level	Other prerequisites	Other prerequisites		
1 semester	graduate	ning of the course of specified registration ly be open for stude	or as announced by t on deadlines. Some s ents with previous kr	de via SB@home at the beginhe lecturer in accordance with the seminars or workshops might onwledge and/or skills in certain specified in the class schedule.	
Contents		,			

A modern topic in complex analysis.

Recommended previous knowledge:

Basic knowledge of the contents of the modules "Introduction to Complex Analysis" and " Complex Analysis" is recommended.

Intended learning outcomes

The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.

 ${f Courses}$ (type, number of weekly contact hours, language — if other than German)

S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 90 minutes

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)



	e title				Abbreviation
Semin	ar Finar	ncial and Insurance Mat	hematics		10-M=SFVM-102-m01
Modul	e coord	inator		Module offered by	
Dean c	of Studi	es Mathematik (Mathen	natics)	Institute of Mathem	natics
ECTS		od of grading	Only after succ. con	npl. of module(s)	
5	nume	rical grade			
Duration	on	Module level	Other prerequisites		
1 seme	ester	graduate	-		de via SB@home at the begin-
			1 -	•	ne lecturer in accordance with the
			' =		seminars or workshops might on-
			1 '	•	owledge and/or skills in certain
			areas. Where applic	able, details will be	specified in the class schedule.
Conter	nts				
A mod	ern topi	ic in financial and insura	ance mathematics.		
Familia	arity wit		odules "Introduction t	o Stochastic Financia	al Mathematics" and "Stochastics
1" IS St	rongly i	recommended.			at mathematics and Stochastics
	<u> </u>	recommended. ning outcomes			armathematics and Stochastics
Intend The stu	ed lear	ning outcomes able to elaborate a con		ppic. This includes co	omprehending and structuring of ate in a scientific discussion.
Intend The stu the top	ed lear udent is oic and	ning outcomes able to elaborate a con	preparing a talk and t	ppic. This includes co he ability to participa	omprehending and structuring of ate in a scientific discussion.
Intend The stu the top Course	ed lear udent is pic and es (type	ning outcomes sable to elaborate a con the available literature,	preparing a talk and t act hours, language –	ppic. This includes co he ability to participa - if other than Germa	omprehending and structuring of ate in a scientific discussion.
The stuthe top Course S (no in	ed learn udent is pic and es (type nformated of ass	ning outcomes sable to elaborate a con the available literature, , number of weekly cont tion on SWS (weekly con	preparing a talk and t act hours, language – ntact hours) and cours language — if other th	ppic. This includes co he ability to participa - if other than Germa e language available an German, examina	omprehending and structuring of ate in a scientific discussion.

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



Modul	Module title				Abbreviation	
Seminar in Geometry and Topology			gy		10-M=SGMT-102-m01	
Module coordinator				Module offe	red by	
Dean o	f Studi	es Mathematik (Mat	hematics)	Institute of I	Mathematics	
ECTS	Meth	od of grading	Only after succ.	compl. of module	e(s)	
5	nume	rical grade				
Duratio	on	Module level	Other prerequisi	Other prerequisites		
1 semester graduate		ning of the cours specified registra ly be open for stu	Registration for the seminar must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might only be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule.			
Contents						
A modern topic in geometry and topology.						

Basic knowledge of the contents of the modules "Introduction to Differential Geometry" and "Introduction to Topology" is recommended.

Intended learning outcomes

The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.

 ${f Courses}$ (type, number of weekly contact hours, language — if other than German)

S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 90 minutes

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Mathematical Physics (2012)



Modu	le title	,			Abbreviation	
Giova	nni-Proc	li Seminar (Master)			10-M=SGPC-102-m01	
Modu	le coord	inator		Module offered by		
Dean	Dean of Studies Mathematik (Mathematics)		atics)	Institute of Mathen	natics	
ECTS			Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Durati	Duration Module level Other prerequ		Other prerequisites			
1 sem	ester	graduate	ning of the course o specified registratio ly be open for stude	r as announced by t n deadlines. Some : nts with previous kr	ade via SB@home at the begin- the lecturer in accordance with the seminars or workshops might on- nowledge and/or skills in certain specified in the class schedule.	
Contents						
A mod	dern topi	ic in the research experti	se of the current hold	er of the Giovanni P	rodi Chair.	
Intend	ded lear	ning outcomes				
					omprehending and structuring of ate in a scientific discussion.	
Cours	es (type	, number of weekly cont	act hours, language –	- if other than Germa	an)	
S (no	informat	tion on SWS (weekly con	tact hours) and cours	e language availabl	e)	
		sessment (type, scope, la ion on whether module o			ation offered — if not every seme-	
minar sentat	present tion of a		minutes), b) written e	elaboration of conte	ing methods of assessment: a) sents equivalent to a seminar pre-	
	tion of p					
Additi	ional inf	ormation				
Workl	oad					
	,					
Teach	Teaching cycle					
Referr	Referred to in LPO I (examination regulations for teaching-degree programmes)					
-						
Modu	le appea	ars in				
Maste	Module appears in Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011)					

Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)



Module	e title				Abbreviation	
Interdi	sciplin	ary Seminar			10-M=SIDZ-102-m01	
Module	e coord	linator		Module offered by		
Dean o	f Studi	es Mathematik (Math	ematics)	Institute of Mathen	natics	
ECTS	Meth	od of grading	Only after succ. compl. of module(s)			
5	nume	rical grade				
Duratio	Duration Module level		Other prerequisites			
1 semester graduate		graduate	ning of the course o specified registratio ly be open for stude	Registration for the seminar must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might only be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule.		
Conten	its					
A mode	ern top	ic in mathematics wit	h interdisciplinary aspec	ts.		
Intend	ed lear	ning outcomes				
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.						
Courses (type, number of weekly contact hours, language — if other than German)						
S (no ir	nforma	tion on SWS (weekly	contact hours) and cours	e language available	e)	
			e, language — if other that le can be chosen to earn		ation offered — if not every seme-	
minar p sentati	oresent on of a		120 minutes), b) written e tes		ng methods of assessment: a) sents equivalent to a seminar pre-	
Allocat	ion of	places				
			,			
Additio	nal inf	ormation				
Worklo	ad					
Teachi	ng cvcl	le				
Referre	ed to in	LPO I (examination	regulations for teaching-	degree programmes)		
		(* 2		3 · · · · · · · · · · · · · · · · · ·		
Module	e appe	ars in				
		ree (1 major) Mathema	atics (2012)			
	_	ree (1 major) Mathema				
	_	ree (1 major) Economa				
Master	's degr	ee (1 major) Mathema	atical Physics (2012)			
Mactor	Agetor's degree (4 major) Computational Mathematics (2042)					



Module	e title				Abbreviation	
Semina	ar in Nu	ımerical Mathemati	cs and Applied Analysis		10-M=SNMA-102-m01	
Module coordinator				Module offered by		
Dean o	f Studi	es Mathematik (Ma	thematics)	Institute of Mathen	natics	
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites	Other prerequisites		
1 semester graduate Re ni sp ly		ning of the course of specified registration ly be open for students.	Registration for the seminar must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might only be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule.			
Conten	its		,			

A modern topic in numerical mathematics or applied analysis.

Recommended previous knowledge:

Depending on the content, basic and advanced knowledge from different areas of analysis and/or numerical mathematics is required. In case of doubt, it is recommended to consult the lecturer.

Intended learning outcomes

The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.

 ${f Courses}$ (type, number of weekly contact hours, language — if other than German)

S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 90 minutes

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module					Abbreviation	
Semina	ar in Op	otimization			10-M=SOPT-102-m01	
Module	coord	inator		Module offered	by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Math	nematics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Registration for the seminar must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the			
			specified registration deadlines. Some seminars or workshops might on-			
			ly be open for students with previous knowledge and/or skills in certain			
			areas. Where applicable, details will be specified in the class schedule.			
Conten	ts					
A mode	ern topi	ic in optimisation.				
Intende	ed lear	ning outcomes				
				•	s comprehending and structuring of cipate in a scientific discussion.	
Course	s (type	, number of weekly conta	act hours, language –	- if other than Ge	rman)	
S (no ir	nformat	tion on SWS (weekly cont	tact hours) and cours	e language availa	able)	
		sessment (type, scope, la ion on whether module c	-		ination offered — if not every seme-	
minar p	resent	•			owing methods of assessment: a) sentents equivalent to a seminar pre-	

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module	Module title				Abbreviation	
Seminar in Statistics					10-M=SSTA-102-m01	
Module coordinator				Module offered by	,	
Dean of Studies Mathematik (Mathematics)			hematics)	Institute of Mathe	matics	
ECTS	S Method of grading Only after succ. co		compl. of module(s)	mpl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequis	Other prerequisites		
1 semester graduate Registration for the seminar must be not ning of the course or as announced by specified registration deadlines. Som ly be open for students with previous areas. Where applicable, details will be		the lecturer in accordance with the seminars or workshops might on- nowledge and/or skills in certain				

A modern topic in statistics.

Recommended previous knowledge:

Basic knowledge of stochastics is required, such as that acquired in the "Stochastics 1" module. Knowledge of the contents of the module "Stochastics 2" is also recommended. Depending on the content of the course, other prior knowledge may also be helpful; consultation with the lecturer is recommended.

Intended learning outcomes

The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.

Courses (type, number of weekly contact hours, language — if other than German)

S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 60 to 90 minutes

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



Module title	<u> </u>			Abbreviation
Algebraic Top	oology			10-M=VATP-102-m01
Module coord	dinator		Module offered by	
Dean of Stud	ies Mathematik (Mat	thematics)	Institute of Mathen	natics
ECTS Meth	od of grading	Only after succ. co	mpl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisite	S	
graduate Registration for the ning of the course the specified regis to qualify for admi certain percentage the respective deta exercise will be co sessment. If stude assessment over the gistration for assess will be admitted to ster. For assessment		or as announced by to tration deadlines. Center is signed to assessment of exercises). The least least the beginning of the series at the obtained the ne course of the sement into effect. Strassessment in the course of the course of the sement assessment in the course of the sement into effect.	ade via SB@home at the begin- he lecturer in accordance with rtain prerequisites must be met (e. g. successful completion of a cturer will inform students about of the course. Registration for the n of will to seek admission to as- e qualification for admission to ester, the lecturer will put their re- udents who meet all prerequisites urrent or in the subsequent seme- dents will have to obtain the qua-	

Homology, homotopy invariance, exact sequences, cohomology, application to the topology of Euclidean spaces.

Recommended previous knowledge:

Basic knowledge of topology is assumed, such as can be acquired in the module "Introduction to Topology".

Intended learning outcomes

The student is acquainted with advanced results in algebraic topology.

Courses (type, number of weekly contact hours, language - if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (approx. 90 to 120 minutes; usually chosen), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups of 2 candidates (approx. 30 minutes total) Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 115 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Mathematical Physics (2012)

exchange program Mathematics (2023)



Module title				Abbreviation
Discrete Math	nematic			10-M=VDIM-102-m01
Module coord	linator		Module offered by	
Dean of Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
5 nume	rical grade			
Duration	Module level	Other prerequisites		
1 semester	semester graduate Registration for the ning of the course of the specified regist to qualify for admiss certain percentage the respective detail exercise will be consessment. If student assessment over the gistration for assess will be admitted to ster. For assessment		r as announced by thation deadlines. Cersion to assessment (of exercises). The lect is at the beginning of sidered a declaration its have obtained the ecourse of the sement into effect. Stuassessment in the curses.	ne lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a turer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their residents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quadrates.

Advanced methods and results in a selected field of discrete mathematics (e. g. coding theory, cryptography, graph theory or combinatorics)

Recommended previous knowledge:

Basic knowledge of the contents of the module "Introduction to Discrete Mathematics" is required.

Intended learning outcomes

The student is acquainted with advanced results in a selected topic in discrete mathematics.

Courses (type, number of weekly contact hours, language - if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places -Additional information -Workload -Teaching cycle



Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title			Abbreviation	
Dynamical Sy	stems and Control			10-M=VDSR-102-m01
Module coord	linator		Module offered by	
Dean of Studi	ies Mathematik (Mathen	natics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
5 nume	erical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessment	r as announced by the ration deadlines. Ceresion to assessment (of exercises). The lector is at the beginning of sidered a declaration its have obtained the ecourse of the sement into effect. Streassessment in the curses.	nde via SB@home at the begin- the lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a cturer will inform students about of the course. Registration for the en of will to seek admission to as- equalification for admission to ester, the lecturer will put their re- udents who meet all prerequisites urrent or in the subsequent seme- dents will have to obtain the qua- new.

Basics in dynamical systems and control: non-linear dynamics, stability theory, ergodic theory, Hamiltonian systems; selected advanced topics, e. g. networked dynamical systems, non-linear stability, dynamics with restricted communication, entropy of dynamical systems.

Recommended previous knowledge:

Basic knowledge of the contents of the module "Ordinary Differential Equations" is useful.

Intended learning outcomes

The student masters the mathematical methods in the theory of dynamic systems and control, and is able to analyse their quality.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

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Allocation of places
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Additional information
Workload
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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Special Topic	s in Financial Mathem	atics		10-M=VFNM-102-m01
Module coord	linator		Module offered by	
Dean of Studi	es Mathematik (Mathe	ematics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 nume	rical grade			
Duration	Module level	Other prerequisites		
Registration for the ning of the course of the specified regist to qualify for admis certain percentage the respective deta exercise will be consessment. If studer assessment over the gistration for asses will be admitted to ster. For assessment			r as announced by the ration deadlines. Ceresion to assessment (of exercises). The lector is at the beginning of sidered a declaration its have obtained the ecourse of the sement into effect. Streassessment in the curses.	de via SB@home at the beginne lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a sturer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their redents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quanew.

Selected topics in financial mathematics, e. g. conditional expectation and martingales, fundamental theorem of asset pricing in discrete time for finite spaces, American put, Snell envelope, stopping time, optimal stopping, stochastic integration, stochastic differential equations and Ito calculus, Black-Merton-Scholes model.

Recommended previous knowledge:

Familiarity with the contents of the modules "Introduction to Stochastic Financial Mathematics" and "Stochastics 1" is strongly recommended.

Intended learning outcomes

The student is acquainted with advanced results in financial mathematics. He/She gains the ability to work on contemporary research questions in financial mathematics and can apply his/her skills to complex problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (approx. 90 to 120 minutes; usually chosen), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups of 2 candidates (approx. 30 minutes total)

Language of assessment: German, English

Allocation of places --Additional information --Workload --Teaching cycle ---



Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



Module title				Abbreviation
Groups and t	heir Representations	s		10-M=VGDS-102-m01
Module coord	linator		Module offered by	
Dean of Stud	ies Mathematik (Mat	:hematics)	Institute of Mathen	natics
ECTS Meth	od of grading	Only after succ. cor	mpl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites	5	
1 semester	graduate	ning of the course of the specified regist to qualify for admis certain percentage the respective deta exercise will be con sessment. If studen assessment over th gistration for asses will be admitted to ster. For assessmen	Other prerequisites Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisit will be admitted to assessment in the current or in the subsequent sem ster. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.	

Finite permutation groups and character theory of finite groups, interrelations and special techniques such as the S-rings of Schur.

Recommended previous knowledge:

Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".

Intended learning outcomes

The student masters advanced algebraic concepts and methods. He/She gains the ability to work on contemporary research questions in group theory and representation theory and can apply his/her skills to complex problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (approx. 90 to 120 minutes; usually chosen), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups of 2 candidates (approx. 30 minutes total)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places -Additional information -Workload --



Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Geometrical	Mechanics		_	10-M=VGEM-102-m01
Module coord	linator		Module offered by	
Dean of Stud	ies Mathematik (Mat	hematics)	Institute of Mather	natics
ECTS Meth	od of grading	Only after succ. co	mpl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites	5	
1 semester	graduate	ning of the course of the specified regist to qualify for admis certain percentage the respective deta exercise will be con sessment. If studer assessment over th gistration for asses will be admitted to ster. For assessmen	Other prerequisites Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisit will be admitted to assessment in the current or in the subsequent sem ster. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.	

Introduction to geometric mechanics: basic notions of differential geometry and symplectic geometry, Euler-Lagrange equations, Hamiltonian mechanics on manifolds.

Recommended previous knowledge:

Advanced knowledge of differential geometry is required, such as can be acquired in the module "Differential Geometry". Knowledge of the contents of the module "Introduction to Topology" is also recommended. Knowledge of theoretical mechanics can also be useful.

Intended learning outcomes

The student is able to apply fundamental methods and concepts of geometry to problems in mechanics, and knows about the interrelation of these fields.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (approx. 90 to 120 minutes; usually chosen), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups of 2 candidates (approx. 30 minutes total)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: definall, English
Allocation of places
Additional information
Workload



Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation	
Aspects of G	eometry			10-M=VGEO-102-m01	
Module coor	dinator		Module offered by		
Dean of Stud	ies Mathematik (Mathe	ematics)	Institute of Mathem	natics	
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)		
5 num	erical grade				
Duration	Module level	Other prerequisites	Other prerequisites		
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessment	Other prerequisites Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisit will be admitted to assessment in the current or in the subsequent sem ster. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.		

In-depth discussion of a special type of geometry taking into account recent developments and interrelations with other mathematical structures, e. g. topological geometries, diagram geometries.

Recommended previous knowledge:

Basic knowledge from the modules "Differential Geometry" and "Introduction to Topology" is recommended.

Intended learning outcomes

The student is acquainted with advanced results in a selected field of geometry and can apply his/her skills to complex problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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	data record Master (120 ECTS) Mathematik - 2010	



Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Mathematical Physics (2012)



Module title			Abbreviation	
Basics in Mat	thematics		10-M=VGRM-102-m01	
Module coord	dinator		Module offered by	
Dean of Stud	ies Mathematik (Mat	thematics)	Institute of Mathematics	
ECTS Meth	od of grading	Only after succ. cor	mpl. of module(s)	
5 nume	erical grade			
Duration	Module level	Other prerequisites	S	
1 semester	graduate	ning of the course of the specified regist to qualify for admis certain percentage the respective deta exercise will be con sessment. If studen assessment over th gistration for assess will be admitted to	Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re gistration for assessment into effect. Students who meet all prerequisite will be admitted to assessment in the current or in the subsequent seme ster. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.	

and philosophy. Intended learning outcomes

The student is acquainted with the foundational methods in mathematics and logic.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

Discussion of problems and questions on the foundation of mathematics, applying methods of set theory, logic

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010)

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 129 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Master's degree (1 major) Mathematical Physics (2012)



Module tit	le			Abbreviation	
Industrial	Statistics 2			10-M=VIST-102-m01	
Module co	ordinator		Module offered by	I.	
Dean of St	udies Mathematik (Ma	thematics)	ics) Institute of Mathematics		
ECTS M	ethod of grading	Only after succ. co	ompl. of module(s)		
10 nu	merical grade				
Duration	Module level	Other prerequisite	es		
1 semeste	graduate	ning of the course the specified regis to qualify for admi certain percentage the respective deta exercise will be co sessment. If stude assessment over t gistration for asses will be admitted to	Other prerequisites Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisite will be admitted to assessment in the current or in the subsequent seme ster. For assessment at a later date, students will have to obtain the qualification for a deviation of the subsequent seme ster.		

Linear models, regression analysis, nonlinear regression, experimental design, basics in time series modelling, basics in empirical time series analysis, methods of exponential smoothing, predictions and prediction domains, statistical process monitoring.

Intended learning outcomes

The student masters advanced statistical methods for industrial applications.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 131 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011)



Module title				Abbreviation
Field Arithme	tics			10-M=VKAR-102-m01
Module coord	linator		Module offered by	
Dean of Studi	es Mathematik (Mathen	natics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessment	r as announced by the ration deadlines. Ceresion to assessment (of exercises). The lector is at the beginning of sidered a declaration its have obtained the ecourse of the sement into effect. Studies assessment in the curses.	de via SB@home at the beginne lecturer in accordance with tain prerequisites must be met e.g. successful completion of a turer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their readents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quanew.

Combination of Galois theory, group theory and the theory of function fields with the aim of application in number theory, e. g. topics around Hilbert's irreducibility theorem, permutation polynomials (e. g. Calitz-Wan-conjecture) and the inverse problem in Galois theory.

Recommended previous knowledge:

Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".

Intended learning outcomes

The student masters advanced algebraic concepts and methods. He/She gains the ability to work on contemporary research questions in algebra and can apply his/her skills to complex problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

Language of assessment. German, English
Allocation of places
Additional information
Workload
Teaching cycle



Referred to in LPO I (examination regulations for teaching-degree programmes)
Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010)



Module title				Abbreviation
Mathematical Imaging				10-M=VMBV-102-m01
Module coord	linator	_	Module offered by	
Dean of Studi	ies Mathematik (Math	ematics)	Institute of Mathematics	
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
5 nume	erical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessment	Registration for the exercise must be made via SB@home at the begin ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be me to qualify for admission to assessment (e. g. successful completion of certain percentage of exercises). The lecturer will inform students about he respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their gistration for assessment into effect. Students who meet all prerequis will be admitted to assessment in the current or in the subsequent sets. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.	

Mathematical fundamentals of image processing and computer vision such as elementary projective geometry, camera models and camera calibration, rigid and non-rigid registration, reconstruction of 3D objects from camera pictures; algorithms; module might also include an introduction to geometric methods and tomography.

Recommended previous knowledge:

Basic knowledge of functional analysis, such as that taught in the module "Functional Analysis", is recommended.

Intended learning outcomes

The student masters the mathematical methods in the theory of image processing and knows about their main fields of application.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Language of assessment: German, English

Allocat	ion	of	p	laces	

Additional information

Teaching cycle

Workload

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Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 135 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Selected Topics in Mathematical Physics				10-M=VMPH-102-m01
Module coor	dinator		Module offered by	
Dean of Stud	dies Mathematik (Mat	hematics)	Institute of Mathematics	
ECTS Met	hod of grading	Only after succ. con	npl. of module(s)	
5 num	erical grade			
Duration	Module level	Other prerequisites	,	
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a	Other prerequisites Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be ment to qualify for admission to assessment (e. g. successful completion of certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to a sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their gistration for assessment into effect. Students who meet all prerequisity will be admitted to assessment in the current or in the subsequent senset. For assessment at a later date, students will have to obtain the qualification.	

Selected topics in mathematical physics (e. g. differential equations of mathematical physics, probability theory, hydrodynamics, hyperbolic conservation equations, mathematical materials science, quantum mechanics).

Recommended previous knowledge:

Depending on the content, basic and advanced knowledge from different areas of analysis is required. In case of doubt, it is recommended to consult the lecturer.

Intended learning outcomes

The student is acquainted with advanced results in a field in mathematical physics. He/She knows mathematical methods in mathematical physics and can apply them to solve problems in physics.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

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Allocation of places
Additional information
Workload



Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Modul Theory				10-M=VMTH-102-m01
Module coord	linator		Module offered by	
Dean of Studi	es Mathematik (Mathe	matics)	Institute of Mathematics	
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
5 nume	rical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If student assessment over the gistration for assess will be admitted to a	Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to a sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their gistration for assessment into effect. Students who meet all prerequisi will be admitted to assessment in the current or in the subsequent senset. For assessment at a later date, students will have to obtain the qualification for admission to a sterm for a substitute of the senset of the subsequent senset.	

Basics in module theory: modules and module spaces, canonical decomposition and representations, simple, semi-simple and complex modules, module trees and their defibrations, distorsion theorems, reduction theorems.

Recommended previous knowledge:

Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".

Intended learning outcomes

The student masters mathematical methods in module theory and is able to analyse their quality.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Language of assessment: German, English

Allocation of places
Additional information
Workload
Teaching cycle



Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Mathematical Physics (2012)



Module title	·			Abbreviation
Non-Linear Analysis				10-M=VNAN-102-m01
Module coord	linator		Module offered by	
Dean of Studi	ies Mathematik (Mather	natics)	Institute of Mathematics	
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
5 nume	erical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a	Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to a sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their gistration for assessment into effect. Students who meet all prerequisit will be admitted to assessment in the current or in the subsequent sem ster. For assessment at a later date, students will have to obtain the qualification.	

Methods in nonlinear analysis (e. g. topological methods, monotony and variational methods) with applications.

Recommended previous knowledge:

We recommend basic knowledge of functional analysis and partial differential equations, such as can be acquired in the modules "Introduction to Functional Analysis" and "Applied Analysis".

Intended learning outcomes

The student is acquainted with the concepts of non-linear analysis, can compare them and assess their applicability on practical problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 141 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Numeric of Partial Differential Equations				10-M=VNPE-102-m01
Module coord	linator		Module offered by	
Dean of Studi	ies Mathematik (Mather	natics)	Institute of Mathematics	
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	Other prerequisites Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be more to qualify for admission to assessment (e.g., successful completion of certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for exercise will be considered a declaration of will to seek admission assessment. If students have obtained the qualification for admission assessment over the course of the semester, the lecturer will put the gistration for assessment into effect. Students who meet all prerequivalled by admitted to assessment in the current or in the subsequent sets. For assessment at a later date, students will have to obtain the lification for admission to assessment anew.		the lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a sturer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their resudents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the qua-

Types of partial differential equations, qualitative properties, finite differences, finite elements, error estimates (numerical methods for elliptic, parabolic and hyperbolic partial differential equations; finite elements method, discontinuous Gelerkin finite elements method, finite differences and finite volume methods).

Recommended previous knowledge:

We recommend basic knowledge of functional analysis and partial differential equations, such as can be acquired in the modules "Introduction to Functional Analysis" and "Applied Analysis".

Intended learning outcomes

The student is acquainted with advanced methods for discretising partial differential equations.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

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Allocation of places
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Additional information
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Norkload
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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title	,			Abbreviation
Selected Top	ics in Optimization			10-M=VOPT-102-m01
Module coord	dinator		Module offered by	
Dean of Stud	ies Mathematik (Ma	thematics)	Institute of Mathem	atics
ECTS Meth	od of grading	Only after succ. cor	mpl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites	5	
Duration Module level Other prerequisit 1 semester graduate Registration for the specified registron qualify for admicertain percentage the respective defended exercise will be consistent assessment. If studiassessment over gistration for assemble will be admitted to the specified registration for assemble will be admitted to the seminary of the course the specified registration for assemble will be admitted to the seminary of the course the specified registration for assemble will be admitted to the seminary of the course the specified registration for assemble will be admitted to the seminary of the course the specified registration for assemble will be admitted to the seminary of the course the specified registration for assemble will be admitted to the seminary of the course the specified registration for assemble will be admitted to the seminary of the course the specified registration for assemble will be admitted to the seminary of the course the specified registration for assemble will be admitted to the seminary of the seminary of the course the specified registration for assemble will be admitted to the seminary of the se		or as announced by the ration deadlines. Certains to assessment (of exercises). The lectails at the beginning of a sidered a declaration at the lectains have obtained the ecourse of the semensment into effect. Stuassessment in the curses.	ne lecturer in accordance with tain prerequisites must be met e. g. successful completion of a turer will inform students about f the course. Registration for the n of will to seek admission to aster, the lecturer will put their redents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quadratic standard standard semedents will have to obtain the quadratic semedents will have to obtain the quadratic semedents will be subsequent semedents will be subsequent semedents will be subsequent semedents.	

Selected topics in optimization, e. g. inner point methods, semidefinite programs, non-smooth optimization, game theory, optimization with differential equations.

Intended learning outcomes

The student is acquainted with advanced methods in continuous optimization. He gains the ability to work on contemporary research questions in continuous optimization.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 145 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Computational Mathematics (2012)



Module tit	le		Abbreviation	
Optimal Co	ontrol		10-M=VOST-102-m01	
Module co	ordinator		Module offered by	
Dean of St	udies Mathematik (Ma	thematics)	Institute of Mathematics	
ECTS Me	thod of grading	Only after succ. con	npl. of module(s)	
5 nu	merical grade			
Duration	Module level	Other prerequisites		
Duration 1 semester graduate Registration for ning of the count the specified rest to qualify for accertain percents the respective of exercise will be sessment. If studies assessment over gistration for assessment will be admitted ster. For assess		ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a	In for the exercise must be made via SB@home at the begin- course or as announced by the lecturer in accordance with ed registration deadlines. Certain prerequisites must be met or admission to assessment (e. g. successful completion of a centage of exercises). The lecturer will inform students about tive details at the beginning of the course. Registration for the ll be considered a declaration of will to seek admission to as- If students have obtained the qualification for admission to at over the course of the semester, the lecturer will put their re- or assessment into effect. Students who meet all prerequisites nitted to assessment in the current or in the subsequent seme- sessment at a later date, students will have to obtain the qua-	

Basics in optimal control of ordinary and partial differential equations, theory of optimal control, conditions for optimality, methods for numerical solution.

Recommended previous knowledge:

We recommend basic knowledge of functional analysis and ordinary differential equations, such as can be acquired in the modules "Introduction to Functional Analysis" and "Ordinary Differential Equations". Knowledge of the contents of the module "Basics in Optimization" may also be useful.

Intended learning outcomes

The student is acquainted with advanced methods in optimal control. He gains the ability to work on contemporary research questions in continuous optimization.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Language of assessment: German, English

Allocation of places		
Additional information		
Workload		
Teaching cycle		



Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Quantum Con	trol and Quantum Comp	outing		10-M=VQKC-102-m01
Module coord	linator		Module offered by	
Dean of Studi	es Mathematik (Mathen	natics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
5 nume	erical grade			
Duration	Module level	Other prerequisites		
Duration Module level Other prerection ning of the control the specified to qualify for certain percent exercise will sessment. If assessment gistration for will be admit ster. For ass		ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessment	r as announced by the ration deadlines. Ceresion to assessment (of exercises). The least the beginning of sidered a declaration ts have obtained the ecourse of the sement into effect. Streassessment in the curses.	nde via SB@home at the begin- the lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a cturer will inform students about of the course. Registration for the en of will to seek admission to as- equalification for admission to ester, the lecturer will put their re- udents who meet all prerequisites arrent or in the subsequent seme- dents will have to obtain the qua- new.

Basics in dynamics of quantum-mechanical systems (e. g. density operators, observables, Schrödinger equation, Liouville-von-Neumann equation), bilinear control systems in quantum mechanics (e. g. finite-dimensional spin systems and/or infinite-dimensional Schrödinger equations with external control), applications (e. g. in quantum computing or magnetic resonance spectroscopy).

Intended learning outcomes

The student is acquainted with advanced methods in quantum-mechanical control systems. He gains the ability to work on contemporary research questions in and applications of control systems in quantum mechanics.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places
Additional information
Workload
Teaching cycle



Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Statistical Ar	nalysis			10-M=VSTA-102-m01
Module coord	dinator		Module offered by	
Dean of Stud	ies Mathematik (Mat	hematics)	Institute of Mather	natics
ECTS Meth	od of grading	Only after succ. co	mpl. of module(s)	
10 nume	erical grade			
Duration	Module level	Other prerequisites	5	
Duration Module level Other p 1 semester graduate Registration in the respectation the respectation is sessing assessing gistration will be ster. Fo		ning of the course of the specified regist to qualify for admis certain percentage the respective deta exercise will be con sessment. If studer assessment over th gistration for asses will be admitted to ster. For assessmen	or as announced by the ration deadlines. Center is significant to assessment of exercises). The least the beginning of the series of the semination of the s	ade via SB@home at the beginhe lecturer in accordance with rtain prerequisites must be met (e. g. successful completion of a cturer will inform students about of the course. Registration for the n of will to seek admission to ase qualification for admission to ester, the lecturer will put their reudents who meet all prerequisites urrent or in the subsequent semedents will have to obtain the quance.

Contingency tables, categorical regression, one-factorial variance analysis, two-factorial variance analysis, discriminant function analysis, cluster analysis, principal component analysis, factor analysis.

Recommended previous knowledge:

Basic knowledge of stochastics is required, such as that acquired in the "Stochastics 1" module. Knowledge of the contents of the module "Stochastics 2" is also recommended.

Intended learning outcomes

The student is acquainted with the fundamental methods in statistical analysis and can apply them to practical problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English
Allocation of places
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Additional information
Workload
-
Teaching cycle



Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)



Module title				Abbreviation
Insurance Ma	athematics 2			10-M=VVSM-102-m01
Module coor	dinator		Module offered by	
Dean of Stud	ies Mathematik (Matl	hematics)	Institute of Mathem	atics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 num	erical grade			
Duration	Module level	Other prerequisites		
Duration 1 semester graduate Registration for the ning of the course the specified regist to qualify for admit certain percentage the respective det exercise will be consessment. If students assessment over the gistration for assess will be admitted to ster. For assessment		r as announced by the ration deadlines. Certaion to assessment (of exercises). The lectal state the beginning of sidered a declaration its have obtained the ecourse of the sement into effect. Sturms assessment in the cures of the sement in the cure of the sement in the cures of the sement in the cures of the sement in the cure of the sement in the sement in the cure of the sement in the semen	de via SB@home at the beginne lecturer in accordance with tain prerequisites must be met e.g. successful completion of a turer will inform students about f the course. Registration for the n of will to seek admission to asqualification for admission to ster, the lecturer will put their redents who meet all prerequisites arrent or in the subsequent semelents will have to obtain the quanew.	

This module discusses modern valuation approaches and multiple decrement models regarding one life or two lives: modern valuation in life insurance mathematics, axiomatic derivation of the product measure approach, Markov chain models, Kolmogorov's differential equations, Thiele's differential equations, numerical applications, joint life policies.

Recommended previous knowledge:

Familiarity with the contents of the modules "Insurance Mathematics 1" and "Selected Topics in Financial Mathematics" is strongly recommended.

Intended learning outcomes

The student is acquainted with advanced methods in insurance mathematics. He gains the ability to work on contemporary research questions in insurance mathematics and can apply his/her skills to complex problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

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Allocation of places
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Additional information
Workload
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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)



Module title				Abbreviation
Networked Sy	/stems			10-M=VVSY-102-m01
Module coord	linator		Module offered by	
Dean of Studi	es Mathematik (Mather	matics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
5 nume	erical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	ning of the course of the specified registre to qualify for admission certain percentage of the respective detail exercise will be consessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessment	r as announced by the ration deadlines. Ceresion to assessment (of exercises). The lector is at the beginning of sidered a declaration its have obtained the ecourse of the sement into effect. Studies assessment in the cures in the cures of the sement in the cures is assessment in the cures of the sement in the cures is assessment in the cures is a second in the cure is assessment in the cures is a second in the cure	de via SB@home at the beginne lecturer in accordance with tain prerequisites must be met e.g. successful completion of a turer will inform students about of the course. Registration for the n of will to seek admission to aster, the lecturer will put their readents who meet all prerequisites arrent or in the subsequent semedents will have to obtain the quanew.

Contemporary topics in networked linear and non-linear dynamical systems (homogenous and non-homogenous systems); analysis of control-theoretical aspects (controllability, accessibility, etc.).

Recommended previous knowledge:

Basic knowledge of the contents of the module "Ordinary Differential Equations" is useful.

Intended learning outcomes

The student is acquainted with advanced methods in the field of networked systems. He gains the ability to work on contemporary research questions in networked systems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 155 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Mathematical Physics (2012)



Module title	,			Abbreviation
Time Series A	Time Series Analysis 2			10-M=VZRA-102-m01
Module coord	linator		Module offered by	
Dean of Studi	es Mathematik (Mathen	natics)	Institute of Mathem	natics
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
10 nume	rical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	Registration for the exercise must be made via SB@home at the begin ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be me to qualify for admission to assessment (e. g. successful completion of certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to a sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their gistration for assessment into effect. Students who meet all prerequisity will be admitted to assessment in the current or in the subsequent ser ster. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.		ne lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a turer will inform students about of the course. Registration for the n of will to seek admission to ester, the lecturer will put their residents who meet all prerequisites urrent or in the subsequent semedents will have to obtain the qua-

State-space models, Kalman filter, frequency spaces, Fourier analysis, periodograms, characterisation of autocovariance functions.

Intended learning outcomes

The student is acquainted with advanced methods in time series analysis. He gains the ability to work on contemporary research questions in this field.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2012)

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 157 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011)



Module	title				Abbreviation
Applied	Applied Semiconductor Physics				11-AHL-092-m01
Module	coord	inator		Module offered by	
Managi	ing Dire	ector of the Institute o	of Applied Physics	Faculty of Physics a	and Astronomy
ECTS	Metho	od of grading	Only after succ. co	mpl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisite	Other prerequisites	
1 seme	ster	graduate	sessment. The lect at the beginning of sidered a declarati dents have obtained the course of the sessment into effected to assessment	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective deta at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment of the course of the semester, the lecturer will put their registration for a sessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For a sessment at a later date, students will have to obtain the qualification	

The lecture discusses the principles of Semiconductor Physics and provides an exemplary overview of the main components of electronics, optoelectronics and photonics.

Intended learning outcomes

The students know the characteristics of semiconductors, they have gained an overview of the electronic and phonon band structures of important semiconductors and the resulting electronic, optical and thermal properties. They know the principles of charge transport as well as the Poisson, Boltzmann and continuity equation for the solution of questions. They have gained insights into the methods of semiconductor production and are familiar with the theories of planar technology and recent developments in this field, they have a basic understanding of component production. They understand the structure and way of functioning of the main components of electronics (diode, transistor, field-effect transistor, thyristor, diac, triac), of microwave applications (tunnel, Impatt, Baritt or Gunn diode) and of optoelectronics (photo diode, solar cell, light-emitting diode, semiconductor injection laser), they know the realisation possibilities of low-dimensional charge carrier systems on the basis of semiconductors and their technological relevance, they are familiar with current developments in the field of components.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

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Allocation of places
Additional information



Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)



Module title			Abbreviation
Cosmology			11-AKM-092-m01
Module coor	dinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		of Theoretical Physics	Faculty of Physics and Astronomy
ECTS Meth	od of grading	Only after succ. cor	mpl. of module(s)
6 num	erical grade		
Duration	Module level	Other prerequisites	s
1 semester	graduate	sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment	es must be met to qualify for admission to as- urer will inform students about the respective details the course. Registration for the course will be con- on of will to seek admission to assessment. If stu- ed the qualification for admission to assessment over emester, the lecturer will put their registration for as- ct. Students who meet all prerequisites will be admit- in the current or in the subsequent semester. For as- date, students will have to obtain the qualification for essment anew.

Expanding space-time, Friedmannian cosmology, basics of general relativity, the early universe, inflation, dark matter, primordial nucleosynthesis, cosmic microwave background, structure formation, supercluster, galaxies and galaxy clusters, intergalactic medium, cosmological parameters

Intended learning outcomes

The students have basic knowledge of cosmology. They know the theoretical methods of cosmology and are able to relate them to observations. They have gained insights into current research topics and are able to work on scientific questions.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English
Allocation of places
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Additional information
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Workload
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Feaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title				Abbreviation
Plasma-Astro	Plasma-Astrophysics			11-APL-092-m01
Module coord	dinator		Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics		of Theoretical Physics	Faculty of Physics and Astronomy	
ECTS Meth	od of grading	Only after succ. cor	mpl. of module(s)	
6 nume	erical grade			
Duration	Module level	Other prerequisites	5	
1 semester	graduate	sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment at a later	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective deta at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment of the course of the semester, the lecturer will put their registration for a sessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For a sessment at a later date, students will have to obtain the qualification admission to assessment anew.	

Plasma Astrophysics: Dynamics of charged particles in electric and magnetic fields. Transport equations for energetic particles. Properties of magnetic turbulence. Propagation of solar particles within the solar wind. Particle acceleration via shock waves and via interaction with plasma turbulence. Particle acceleration and transport in galaxies and other cosmic objects.

Intended learning outcomes

The students have basic knowledge of Plasma Astrophysics. They have mastered the theoretical description of motion and acceleration of charged particles in space, they know corresponding measuring methods and can compare and evaluate theory and experiments.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English
Allocation of places
Additional information
Workload
Teaching cycle



Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title	!			Abbreviation
Applied Superconduction 11-ASL-092-m01			11-ASL-092-m01	
Module coo	rdinator		Module offered by	
Managing D	irector of the Institute	of Applied Physics	Faculty of Physics a	and Astronomy
ECTS Met	hod of grading	Only after succ. co	ompl. of module(s)	
6 num	nerical grade			
Duration	Module level	Other prerequisit	es	
1 semester	graduate	sessment. The lect at the beginning of sidered a declarate dents have obtain the course of the sessment into effected to assessment at a later	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective deta at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment of the course of the semester, the lecturer will put their registration for sessment into effect. Students who meet all prerequisites will be adred to assessment in the current or in the subsequent semester. For a sessment at a later date, students will have to obtain the qualification admission to assessment anew.	

Physical principles of superconductivity. Application in energy engineering. Instrumental developments. Methods of materials sciences for the calculation of temperature profiles in superconductors.

Intended learning outcomes

The students have a basic understanding of superconductivity as a macroscopic quantum phenomenon. They are able to evaluate the contributions of materials sciences to the development of superconductivity. They are able to discuss questions on superconductivity in a scientific manner and to critically question developments of energy technology. Furthermore, they can deal with practical mathematical questions.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: once a year, winter semester Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Bachelor' degree (1 major) Physics (2010)

Master's with 1 major Mathematics (2010) JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Mathematik - 2010



Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Nanostructure Technology (2010)

Bachelor' degree (1 major) Nanostructure Technology (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)



Module	Module title			Abbreviation		
Introdu	Introduction to Space Physics			11-ASP-092-m01		
Module	e coord	inator		Module offered by		
_	Managing Director of the Institute of Theoretical Physics and Astrophysics		of Theoretical Physics	Faculty of Physics and Astronomy	Faculty of Physics and Astronomy	
ECTS	Meth	od of grading	Only after succ. cor	mpl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites	S		
1 seme	ster	graduate	sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment in	es must be met to qualify for admission to as- urer will inform students about the respective deta the course. Registration for the course will be con on of will to seek admission to assessment. If stu- ed the qualification for admission to assessment of emester, the lecturer will put their registration for a ct. Students who meet all prerequisites will be admin the current or in the subsequent semester. For a r date, students will have to obtain the qualifications	n- over as- mit- as-	

- 1. Overview
- 2. Dynamics of charged particles in magnetic and electric fields
- 3. Elements of space physics
- 4. The sun and heliosphere
- 5. Acceleration and transport of energetic particles in the heliosphere
- 6. Instruments to measure energetic particles in extraterrestrial space

Intended learning outcomes

The students have basic knowledge of Space Physics, in particular of the characterisation of the dynamics of charged particles in space and in the heliosphere. They know relevant parameters, theoretical concepts and measuring methods.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Allocation of places --Additional information --Workload ---



Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title			Abbreviation
Atmosphere	and Space Physics		11-AWP-092-m01
Module coor	dinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics Faculty of Physics a		Faculty of Physics and Astronomy	
ECTS Meth	od of grading	Only after succ. cor	mpl. of module(s)
6 num	erical grade		
Duration	Module level	Other prerequisites	3
1 semester	graduate	sessment. The lectuat the beginning of sidered a declaration dents have obtained the course of the sessment into effected to assessment	es must be met to qualify for admission to as- urer will inform students about the respective details the course. Registration for the course will be con- on of will to seek admission to assessment. If stu- d the qualification for admission to assessment over emester, the lecturer will put their registration for as- et. Students who meet all prerequisites will be admit- in the current or in the subsequent semester. For as- date, students will have to obtain the qualification for sment anew

Structure of planetary atmospheres. Interaction of planetary atmospheres with the Sun. Physics of clouds. Planetary magnetospheres and interplanetary medium. (Micro) meteorites, asteroids, planetary rings. Atmospheres of exoplanets.

Intended learning outcomes

The students have knowledge of the physics of planetary atmospheres, especially of the atmosphere of the Earth and near-Earth space. They are able to apply the acquired knowledge to the solution of problems of interplanetary space missions.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German or English

Language of assessment. German of English
Allocation of places
Additional information
Workload
Teaching cycle
Referred to in LPO I (examination regulations for teaching-degree programmes)



Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Aerospace Computer Science (2009)

Bachelor' degree (1 major) Aerospace Computer Science (2011)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



	Abbreviation			
Introduction to Plasmaphysics			11-EPP-092-m01	
dinator		Module offered by		
Managing Director of the Institute of Theore and Astrophysics		Faculty of Physics and Astronomy		
od of grading	Only after succ. cor	mpl. of module(s)		
erical grade				
Module level	Other prerequisites	Other prerequisites		
1 semester graduate		Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for		
,	dinator ector of the Institute of sics od of grading erical grade Module level	dinator ector of the Institute of Theoretical Physics sics od of grading Only after succ. control grade Module level Graduate Other prerequisites sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment sessment at a later	dinator ector of the Institute of Theoretical Physics sics od of grading orical grade Module level graduate Other prerequisites Certain prerequisites must be met to qu sessment. The lecturer will inform stude at the beginning of the course. Registrat sidered a declaration of will to seek adn dents have obtained the qualification for the course of the semester, the lecturer sessment into effect. Students who meet ted to assessment in the current or in the	

Plasma Astrophysics: Dynamics of charged particles in electric and magnetic fields, Magnetohydrodynamics, Transport equations for energetic particles, Properties of magnetic turbulence, Propagation of solar particles within the solar wind, Particle acceleration via shock waves and via interaction with plasma turbulence, Particle acceleration and transport in galaxies and other astrophysical objects, Cosmic radiation.

Intended learning outcomes

The students know the principles of Plasma Physics, especially the description of transport phenomena in plasma. They are able to solve basic problems of Plasma Physics and to apply this knowledge to Astrophysics.

Courses (type, number of weekly contact hours, language — if other than German)

V + R (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and

examination regulations) 2009.
Language of assessment: German, English
Allocation of places
Additional information
Workload
Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module titl	е			Abbreviation	
Solid State	Physics 2			11-FK2-092-m01	
Module coordinator Module offered by					
Managing [Director of the Institute	e of Applied Physics	Faculty of Physics a	and Astronomy	
ECTS Me	thod of grading	Only after succ. c	Only after succ. compl. of module(s)		
8 nui	merical grade				
Duration	Module level	Other prerequisit	Other prerequisites		
1 semester graduate		sessment. The lect at the beginning of sidered a declarate dents have obtain the course of the sessment into effected to assessment.	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for		

Advanced Solid-State Physics. Electrons in periodic potential - the band structure. Dynamics in the semi-classical model. Dielectric properties and ferroelectrics. Semiconductors. Magnetism. Superconductivity. Coupled excitations and optical properties [optional]

Intended learning outcomes

The students have specific and advanced knowledge in the field of Solid-State Physics. They are theoretically able to specialise in a sub-discipline of Solid-State Physics.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Module appears in

Allocation of places -Additional information -Workload -Teaching cycle -Referred to in LPO I (examination regulations for teaching-degree programmes)

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 173 / 220
	data record Master (420 ECTS) Mathematik, 2040	



Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module	title				Abbreviation	
Solid State Spectroscopy					11-FKS-092-m01	
Module coordinator Module offered by						
Managin	g Dire	ector of the Institute o	ute of Applied Physics Faculty of Physics and Astronomy			
ECTS I	Metho	od of grading	Only after succ. co	Only after succ. compl. of module(s)		
6 1	nume	rical grade				
Duration	1	Module level	Other prerequisite	Other prerequisites		
1 semester graduate		sessment. The lect at the beginning of sidered a declarate dents have obtain the course of the sessment into effected to assessment.	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for			

Single- and many-particle picture of electrons in solids. Light-matter interaction. Optical spectroscopy. Electron spectroscopy. X-ray spectroscopies.

Intended learning outcomes

The students have specific and advanced knowledge in the field of solid-state spectroscopy. They know different types of spectroscopy and their fields of application. They understand the theoretical principles and the current developments in research.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Module appears in

Allocation of places --Additional information --Workload --Teaching cycle --Referred to in LPO I (examination regulations for teaching-degree programmes) ---



Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Nanostructure Technology (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module	e title				Abbreviation	
Transport Phenomena in Solids				11-FKT-092-m01		
] a			
Module coordinator			Module offered by			
Manag and As	_	ector of the Institute of T ics	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS		d of grading	Only after succ. con	npl. of module(s)		
6		rical grade				
Duratio		Module level	Other prerequisites		116.6	
certain prerequisites must be met to qualify for a design sessment. The lecturer will inform students about at the beginning of the course. Registration for the sidered a declaration of will to seek admission to dents have obtained the qualification for admission the course of the semester, the lecturer will put the sessment into effect. Students who meet all prerested to assessment in the current or in the subsequences.		ents about the respection for the course winission to assessment or admission to assesswill put their registrates all prerequisites were subsequent semested.	ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as-			
Camban			admission to assess	sillent allew.		
Conten		nomona in calida				
		nomena in solids.	_			
		ning outcomes	and knowledge in the	field of transmort ab	anamana in salids	
		nave specific and advar				
		number of weekly con				
		mation on SWS (weekly				011011111111111111111111111111111111111
ster, in	formati	essment (type, scope, on on whether module	can be chosen to earn	a bonus)		•
groups project (approx Assess and will examin	(appro report x. 30 m ment o Il be an ation re	nination (approx. 90 mx. 30 minutes per cand (approx. 8 to 10 pages, inutes) ffered: When and how on the form uregulations) ssessment: German, Er	idate, for modules with time to complete: 1 to often assessment will hader observance of Sec	n less than 4 ECTS ci 4 weeks) or d) preso be offered depends	redits approx. 20 mir entation/seminar pro on the method of ass	nutes) or c) esentation sessment
Allocat	ion of p	laces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Bachelor' degree (1 major) Physics (2010)						
Bachelor' degree (1 major) Physics (2012)						
waster's W	aster's with 1 major Mathematics (2010) JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Mathematik - 2010 page 177 / 220					



Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)



Module title				Abbreviation	
Group Theory				11-GRT-092-m01	
Module coord	dinator		Module offered by		
Managing Dir and Astrophy		e of Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS Meth	od of grading	Only after succ. co	mpl. of module(s)		
6 nume	erical grade				
Duration	Module level	Other prerequisites	Other prerequisites		
1 semester graduate		sessment. The lection at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment at a later	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification fo admission to assessment anew.		

Group theory. Finite groups. Lie groups. Lie algebra. Depiction. Tensors. Classification theorem. Applications.

Intended learning outcomes

Module appears in

The students know the basics of group theory, especially of Lie groups. They are able to identify problems of group theory and to solve them by using the acquired methods. They are able to apply group theory to the formulation and processing of physical problems.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English Allocation of places - Additional information - Workload - Teaching cycle - Referred to in LPO I (examination regulations for teaching-degree programmes) --



Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title					Abbreviation	
Semico	nducto	or Nanostructures			11-HNS-092-m01	
Module	coord	inator		Module offered by		
Managi	ing Dire	ector of the Institute	of Applied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. co	mpl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisite	Other prerequisites		
		sessment. The lect at the beginning o sidered a declarat dents have obtain the course of the s sessment into effected to assessment	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for			

Semiconductor nanostructures are frequently referred to as "artificial materials". In contrast to atoms, molecules or macroscopic crystals, their electronic, optical and magnetic properties can be systematically tailored by changing their size. The lecture addresses technological challenges in the preparation of semiconductor nanostructures of varying dimensions (2D, 1D, oD). It provides the basic theoretical concepts to describe their properties, with a focus on optical properties and light-matter coupling. Moreover, it discusses the challenges and concepts of novel optoelectronic and quantum photonic devices based on such nanostructures, including building blocks for quantum communication and quantum computing architectures.

Intended learning outcomes

The students know the theoretical principles and characteristics of semiconductor nanostructures. They have knowledge of the technological methods to fabricate such structures, and of their applications to novel photonic devices. They are able to apply their knowledge to problems in this field of research.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Language of assessment cerman, English
Allocation of places
-
Additional information
Workload



Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Nanostructure Technology (2010)

Bachelor' degree (1 major) Nanostructure Technology (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Technology of Functional Materials (2010)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)

Master's degree (1 major) Computational Mathematics (2012)

Master's degree (1 major) Functional Materials (2012)



Module title					Abbreviation	
Magnetism					11-MAG-092-m01	
Module	coord	inator		Module offered by		
Managir	ng Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duration	1	Module level	Other prerequisites	Other prerequisites		
,		sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment i	trer will inform stude the course. Registrat on of will to seek adm d the qualification fo mester, the lecturer t. Students who mee n the current or in th date, students will h	alify for admission to as- nts about the respective details ion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for		

Dia- and paramagnetism, exchange interaction, ferromagnetism, antiferromagnetism, anisotropy, domain structure, nanomagnetism, superparamagnetism, experimental methods to measure magnetic properties, Kondo effect.

Intended learning outcomes

The students know basic terms, concepts and phenomena of magnetism and measuring methods for magnetic experiments; they are skilled in simple model building and in the formulation of mathematical-physical approaches and are able to apply them to tasks in the stated areas; they have competencies in independently working on problems of these areas; they are able to evaluate the accuracy of observations and analyses.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.



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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Nanostructure Technology (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title					Abbreviation	
Low-Di	mensio	onal Structures			11-NDS-092-m01	
Module	coord	inator		Module offered by		
Managi	ng Dire	ector of the Institute	of Applied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. co	ompl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisite	Other prerequisites		
		sessment. The lect at the beginning of sidered a declarate dents have obtain the course of the sessment into effected to assessment.	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for			

Low-dimensional structures: Crystal lattice symmetry. Lattice dynamics and growth techniques of low-dimensional structures. Comparison between these structures and volume solids. X-ray diffractometry. Molecular beam epitaxy.

Intended learning outcomes

The students have knowledge of the theoretical principles of the growth of low dimensional structures. They know methods of producing and analysing such structures. They know the bandstructures of the most important semiconductors as well as the fabrication and characteristics of semiconductor heterostructures and MOS-diodes. They are familiar with the subband structure of semiconductor heterostructures and MOS-diodes and can evaluate the importance of many-particle effects. They are able to solve problems related to potentials in one dimension by applying Poisson's equation. They know the k*p perturbation theory and can deduce the 2D subband structure from the bulk band structure. They have knowledge of the meaning of modulation doping and are familiar with the 2D hydrogen atom. They understand how an external magnetic field acts on the properties of a free electron gas in 2D. They have basic knowledge of the meaning of gauging, Landau-quantisation, filling factor and Landau degeneracy. They understand the dependence of various physical properties on the filling factor, and are able to solve implicit problems via numerical methods. They are familiar with elementary excitations in two-dimensional systems.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module	title				Abbreviation	
Numeri	cal Me	thods in Astrophysics			11-NMA-092-m01	
Module	coord	inator		Module offered by		
_	Managing Director of the Institute of Theoret and Astrophysics			Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. cor	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites	Other prerequisites		
Duration Module level 1 semester graduate		sessment. The lectuat the beginning of sidered a declaration dents have obtained the course of the sessment into effected to assessment in	trer will inform stude the course. Registrat on of will to seek adm d the qualification fo emester, the lecturer t. Students who mee n the current or in th date, students will h	alify for admission to as- ents about the respective details cion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for		

Various methods used in astrophysical simulations with special emphasis on their applications. N-body algorithms (tree- and polynomial codes). Particle-mesh methods (particle-in-cell methods). Vlasow methods (e.g., Lattice-Boltzmann). Hyperbolic conservation laws (fluid dynamics, finite difference method, Riemann solver, ENO). Methods of high-performance computing. Message-passing interface (MPI). GPGPU programming (Open-CL).

Intended learning outcomes

The students are able to solve typical problems and equations of Astrophysics and other subdisciplines of Physics with the help of numerical simulations. They are especially capable of choosing adequate strategies to approach such problems and of validating the results.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Allocation of places -Additional information -Workload -Teaching cycle



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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Mathematical Physics (2009)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) FOKUS Physics (2010)



le			Abbreviation	
cs			11-NOP-092-m01	
ordinator		Module offered by		
Director of the Institute	e of Applied Physics	Faculty of Physics a	and Astronomy	
ethod of grading	Only after succ. c	ompl. of module(s)		
ımerical grade				
Module level	Other prerequisit	Other prerequisites		
Duration Module level 1 semester graduate		cturer will inform stude of the course. Registrat tion of will to seek adm ned the qualification for semester, the lecturer ect. Students who mee it in the current or in the	ents about the respective details tion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- ne subsequent semester. For as-	
	ordinator Director of the Institute ethod of grading americal grade Module level	Director of the Institute of Applied Physics ethod of grading merical grade Module level graduate Certain prerequisit sessment. The lea at the beginning of sidered a declara dents have obtain the course of the sessment into eff ted to assessment sessment at a late	ordinator Director of the Institute of Applied Physics ethod of grading merical grade Module level Other prerequisites	

Theoretical principles. Focussing of light. Microscopy. Optical nearfield probes. Nearfield microscopy. Single quantum emitters. Light emission in nano-tailored environments. Plasmons. Optical antennas.

Intended learning outcomes

The students have specific and advanced knowledge in the field of nano-optics. They are familiar with the theoretical principles and application areas of nano-optics and with current developments in this field.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Allocation of places **Additional information**

Teaching cycle

Workload

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Bachelor' degree (1 major) Physics (2010)

Master's with 1 major Mathematics (2010)

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Mathematik - 2010



Bachelor' degree (1 major) Physics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Modul	e title				Abbreviation	
Physic	Physics of Complex Systems				11-PKS-092-m01	
Modul	e coord	linator		Module offered by		
_	ging Dir strophy		e of Theoretical Physics	neoretical Physics Faculty of Physics and Astronomy		
ECTS	Meth	od of grading	Only after succ. co	mpl. of module(s)		
6	nume	rical grade				
Durati	on	Module level	Other prerequisites	Other prerequisites		
		graduate	sessment. The lectuat the beginning of sidered a declaration dents have obtained the course of the sessment into effected to assessment	urer will inform stude the course. Registrat on of will to seek adn d the qualification fo emester, the lecturer ct. Students who mee in the current or in th date, students will h	alify for admission to asents about the respective details tion for the course will be connission to assessment. If stuor admission to assessment over will put their registration for aset all prerequisites will be admitted subsequent semester. For aseave to obtain the qualification for	

- 1. Theory of critical phenomena in thermal equilibriumt
- 2. Introduction into the physics out of equilibriumt
- 3. Entropy production and fluctuationst
- 4. Phase transitions away from equilibriumt
- 5. Universalityt
- 6. Spin glassest
- 7. Theory of neural networks

Intended learning outcomes

The students have specific and advanced knowledge in the field of physics of complex systems. They know the methods of Statistical Physics, Computational Physics and non-linear dynamics, which are used to describe such systems. They are able to work on current research problems in this area.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Allocation of places --Additional information --Workload ---



Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Nanostructure Technology (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module	e title				Abbreviation	
Quantı	um Med	chanics II			11-QM2-092-m01	
Module	e coord	linator		Module offered by		
Manag and As	_		of Theoretical Physics	eoretical Physics Faculty of Physics and Astronomy		
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites	Other prerequisites		
Duration Module level 1 semester undergraduate		sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment in the lecture.	urer will inform stude the course. Registrat on of will to seek adm d the qualification for emester, the lecturer et. Students who mee in the current or in th date, students will h	alify for admission to asents about the respective details tion for the course will be connission to assessment. If stuor admission to assessment over will put their registration for aset all prerequisites will be admitted subsequent semester. For aseave to obtain the qualification for		

"Quantum mechanics II" constitutes the central theoretical course of the international Master's program in Physics. It builds upon basics which are acquired in the lecture "Quantum mechanics I" of the Bachelor's degree. While the specific emphasis can be adjusted individually, the core topics that are supposed to be covered should include:

- 1. Second quantisation: Fermions and bosons
- 2. Band structures of particles in a crystal
- 3. Angular momentum, symmetry operators, Lie Algebras
- 4. Scattering theory: Potential scattering, partial wave expansion
- 5. Relativistic quantum mechanics: Klein-Gordon equation, Dirac equation, Loretz group, fine structure splitting of atomic spectra
- 6. Quantum entanglement
- 7. Canonical formalism

Intended learning outcomes

The students acquire in-depth knowledge of advanced quantum mechanics and have a thorough understanding of the mathematical and theoretical concepts of the listed topics. They are able to describe or model problems of modern theoretical Quantum Physics mathematically, to solve problems analytically, to use approximation methods and to interpret the results physically. The course is pivotal to subsequent theory courses in Astrophysics, High-Energy Physics and Condensed Matter/Solid-State Physics. The course is mandatory for all Master's students.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English



Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Nanostructure Technology (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module tit	le			Abbreviation	
Quantum	Phenomena in electron	ic correlated Materials		11-QPM-092-m01	
Module co	ordinator		Module offered by		
Managing	Director of the Institute	e of Applied Physics	Faculty of Physics a	and Astronomy	
ECTS M	ethod of grading	Only after succ. co	ompl. of module(s)		
6 nu	ımerical grade				
Duration	Module level	Other prerequisite	Other prerequisites		
Duration Module level 1 semester graduate		sessment. The lecat the beginning of sidered a declarate dents have obtain the course of the sessment into effected to assessment	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for		

Quantum effects and phenomena in current solid-state research. Correlations. Free electron gas and Fermi liquid. Strongly correlated systems

Intended learning outcomes

The students have specific, advanced knowledge of the current research on Solid-State Physics, especially on quantum effects in strongly correlated systems. They are able to understand the connections between the theoretical description of such systems and the current experimental results.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Module appears in

Allocation of places --Additional information --Workload --Teaching cycle --Referred to in LPO I (examination regulations for teaching-degree programmes) ---



Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title				Abbreviation	
Many Body Q	uantum Theory			11-QVTP-092-m01	
Module coord	inator		Module offered by		
Managing Dire	ector of the Institute of Th sics	neoretical Physics	neoretical Physics Faculty of Physics and Astronomy		
ECTS Metho	od of grading	Only after succ. con	npl. of module(s)		
8 nume	rical grade				
Duration	Module level	Other prerequisites			
		sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment i	trer will inform stude the course. Registrat on of will to seek adm d the qualification fo mester, the lecturer t. Students who mee n the current or in th date, students will h	alify for admission to as- nts about the respective details ion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for	

This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions.

An outline could be:

- 1 Single-particle Green's function
- 2 Review of second quantization
- 3 Diagrammatic method using many particle Green's functions at temperature T=0
- 4 Diagrammatic method for finite T
- 5 Landau theory of Fermi liquids
- 6 Superconductivity
- 7 One-dimensional systems and bosonization

Intended learning outcomes

The students have mastered the principles of quantum field theory in many-particle systems. They are able to apply the acquired methods to current problems of Theoretical Solid-State Physics.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Allocation of places

Additional information

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 197 / 220
	data record Master (120 ECTS) Mathematik - 2010	



Workload

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Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title				Abbreviation	
Relativistic Effects in Mesoscopic Systems				11-RMS-092-m01	
Module co	ordinator		Module offered by		
Managing Director of the Institute of Theoretical Pland Astrophysics			Faculty of Physics and Astronomy		
ECTS Me	ethod of grading	Only after succ. cor	mpl. of module(s)		
5 nu	merical grade				
Duration	Module level	Other prerequisites	Other prerequisites		
1 semester graduate		sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment in	Other prerequisites Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for		

Relativistic effects in mesoscopic systems. - Spin-orbit coupling. - Dirac equation. - Quantum Hall effect. - Topological insulators. - Majorana fermions

Intended learning outcomes

Module appears in

The students have mastered the mathematical methods for the description of relativistic quantum systems, especially in the field of mesoscopic physics. They are able to apply their knowledge to simple systems.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English Allocation of places - Additional information - Workload - Teaching cycle - Referred to in LPO I (examination regulations for teaching-degree programmes)

Master's with 1 major Mathematics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg.	page 199 / 220
	data record Master (con ECTS) Mathematik, and	



Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module	e title				Abbreviation	
Renormalization Theory					11-RNT-092-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Tl and Astrophysics			of Theoretical Physics	eoretical Physics Faculty of Physics and Astronomy		
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites	Other prerequisites		
Duration 1 semester		graduate	sessment. The lectuat the beginning of sidered a declaration dents have obtained the course of the sessment into effected to assessment in	urer will inform stude the course. Registrat on of will to seek adn d the qualification fo emester, the lecturer ct. Students who mee in the current or in th date, students will h	alify for admission to asents about the respective details tion for the course will be connission to assessment. If stuor admission to assessment over will put their registration for aset all prerequisites will be admitted subsequent semester. For aspays to obtain the qualification for	

Renormalisation group methods for Hamiltonian systems. Partial non-linear differential equations with scaling behaviour for dynamics beyond the equilibrium. Classical-critical and quantum-critical phenomena and their relevance for phase diagrams in cryogenic temperatures. Instability of statistical and dynamic mean-field solutions. Stochastic non-linear partial differential equations. Construction of generating functionals. Halperin-Hohenberg-Ma differential equations. Symmetries, e.g. in the stochastic Burgers' equation (KPZ equation). Introduction and comparison of different RG methods.

Intended learning outcomes

The students have gained an overview of renormalisation group methods for non-linear partial differential equations. They know important examples and corresponding solving methods and are able to apply them to specific tasks.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Allocation of places
Additional information
-
Workload
-



Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title				Abbreviation
Relativistical Quantumfield Theory				11-RQFT-092-m01
Module coord	inator		Module offered by	
Managing Dire	ector of the Institute of Th	neoretical Physics Faculty of Physics and Astronomy		and Astronomy
ECTS Metho	od of grading	Only after succ. con	npl. of module(s)	
8 numer	rical grade			
Duration	Module level	Other prerequisites	1	
Duration Module level 1 semester graduate		sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment i	trer will inform stude the course. Registrat on of will to seek adm d the qualification fo mester, the lecturer t. Students who mee n the current or in th date, students will h	alify for admission to as- nts about the respective details ion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for

Symmetries. Lagrange formalism for fields. Field quantisation. Gauge principle and interaction. Perturbation theory. Feynman rules. Quantum electrodynamic processes in Born approximation. Radiative corrections and renormalisation.

Intended learning outcomes

The students have mastered the principles and underlying mathematics of relativistic quantum field theories. They know how to use perturbation theory and how to apply Feynman rules. They are able to calculate basics processes in the framework of quantum electrodynamics in leading order. Moreover, they have a basic understanding of radiative corrections and renormalisation.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English
Allocation of places
-
Additional information
Workload
Teaching cycle



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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title				Abbreviation	
Theory of Relativity				11-RTT-092-m01	
Module coord	linator		Module offered by		
Managing Dir and Astrophy		of Theoretical Physics	neoretical Physics Faculty of Physics and Astronomy		
ECTS Meth	od of grading	Only after succ. cor	npl. of module(s)		
6 nume	erical grade				
Duration	Module level	Other prerequisites	Other prerequisites		
Duration Module level 1 semester graduate		sessment. The lectuat the beginning of sidered a declaration dents have obtained the course of the sessment into effected to assessment	urer will inform stude the course. Registrat on of will to seek adm d the qualification fo emester, the lecturer ct. Students who mee in the current or in th date, students will h	alify for admission to as- nts about the respective details cion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for	

Mathematical foundations of the theory of relativity; differential forms; brief summary of special relativity; elements of differential geometry; electrodynamics as an example of a relativistic gauge theory; field equations of general relativity; stellar models; introduction to cosmology; Hamiltonian formulation

Intended learning outcomes

The students are familiar with the basic physical and mathematical concepts of general relativity. They have a mathematical understanding of the formulation of general relativity on the basis of differential forms. They are able to apply the acquired knowledge to problems of Astrophysics and cosmology.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2000

examination regulations) 2009.
Language of assessment: German, English
Allocation of places
Additional information
Workload
Teaching cycle



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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title Abbreviation					Abbreviation	
Statistics, Data Analysis and Computer Physics			nputer Physics		11-SDC-092-m01	
Module coordinator			Module offered	Module offered by		
Manag	ing Dir	ector of the Institute	of Applied Physics	Faculty of Phys	ics and Astronomy	
ECTS	Meth	od of grading	Only after succ.	compl. of module(s)	
4	nume	rical grade				
Duratio	on	Module level	Other prerequisi	tes		
1 seme	ster	graduate		Certain prerequisites must be met to qualify for admission to as-		
					tudents about the respective details	
			at the beginning	of the course. Regi	stration for the course will be con-	
			sidered a declara	ation of will to seek	admission to assessment. If stu-	
			dents have obtai	ned the qualification	on for admission to assessment over	
			the course of the	semester, the lecti	urer will put their registration for as-	
			sessment into ef	fect. Students who	meet all prerequisites will be admit-	
			ted to assessme	nt in the current or	in the subsequent semester. For as-	
			sessment at a lat	ter date, students v	vill have to obtain the qualification f	
				admission to assessment anew.		
Conten	its		,			
Statisti	ics, dat	ta analysis and com	puter physics.			
Intend	ed lear	ning outcomes				
The stu Physics		have specific and a	dvanced knowledge in t	he field of statistic	s, data analysis and Computational	

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

Allocation of places

Additional information

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012)

Master's with 1 major Mathematics (2010)

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Mathematik - 2010

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Bachelor' degree (1 major) Nanostructure Technology (2010)

Bachelor' degree (1 major) Nanostructure Technology (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



		Abbreviation		
try I and II			11-SUS-092-m01	
dinator		Module offered by		
rector of the Institute rsics	of Theoretical Physics	eoretical Physics Faculty of Physics and Astronomy		
od of grading	Only after succ. cor	mpl. of module(s)		
erical grade				
Module level	Other prerequisites	Other prerequisites		
graduate	sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment at a later	urer will inform stude the course. Registrat on of will to seek adm d the qualification fo emester, the lecturer with t. Students who mee in the current or in the date, students will h	nts about the respective details ion for the course will be consission to assessment. If sturadmission to assessment over will put their registration for astall prerequisites will be admites subsequent semester. For as-	
	linator ector of the Institute sics od of grading erical grade Module level	dinator ector of the Institute of Theoretical Physics sics od of grading Only after succ. control grade Module level Graduate Other prerequisites sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment sessment at a later	linator ector of the Institute of Theoretical Physics sics od of grading erical grade Module offered by Faculty of Physics a Faculty	

Supersymmetry I: Grassmann variable. Coleman-Mandula theorem and Haag-Lopuszanski-Sohnius theorem. Supersymmetry: Algebra and multiplets. Superfield formalism. Breaking of supersymmetry. Supersymmetry II: Minimal supersymmetric standard model. Higgs sector. The spectrum of supersymmetric par-

ticles. Phenomenology of LEP, Tevatron and LHC, supersymmetric neutrino mass models. Violation of R-parity.

Intended learning outcomes

The students have knowledge of the mathematical and physical principles of supersymmetry and supersymmetric models. They understand the theory's formalism and recognise its connections to other models as well as its importance for phenomenology of elementary particles.

Courses (type, number of weekly contact hours, language — if other than German)

V + R (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English
Allocation of places
Additional information
Workload
Teaching cycle



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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)

Master's degree (1 major) Computational Mathematics (2012)

Master's degree (1 major) FOKUS Physics (2006)



Module title				Abbreviation
Theoretical Elementary Particle Physics			-	11-TEP-092-m01
Module coord	linator		Module offered by	
Managing Dir and Astrophy	ector of the Institute of T sics	heoretical Physics	neoretical Physics Faculty of Physics and Astronomy	
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)	
8 nume	rical grade			
Duration	Module level	Other prerequisites	•	
1 semester graduate		sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment i	trer will inform stude the course. Registrat on of will to seek adm d the qualification fo mester, the lecturer t. Students who mee n the current or in th date, students will h	alify for admission to as- nts about the respective details ion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for

Fundamental forces and particles. Groups and symmetries. Quark model. Principles of quantum field theory. Gauge theories. Spontaneous symmetry breaking. Electroweak standard model. Quantum chrome dynamics. Extensions of the standard model.

Intended learning outcomes

The students are familiar with the mathematical methods of Elementary Particle Physics. They understand the structure of the standard model based on symmetry principles and experimental observations. They know calculation methods for the processing of simple problems and processes of Elementary Particle Physics. Furthermore, they know the tests and limits of the standard model and the basics of extended theories.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English
Allocation of places
Additional information
Workload
Teaching cycle



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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title				Abbreviation
Theoretical Solid State Physics			-	11-TFK-092-m01
Module coordinator			Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy		
ECTS Meth	od of grading	Only after succ. compl. of module(s)		
8 nume	erical grade			
Duration	Module level	Other prerequisites	Other prerequisites	
1 semester	graduate	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective detain at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification admission to assessment anew.		nts about the respective details ion for the course will be connission to assessment. If stural admission to assessment over will put their registration for astall prerequisites will be admites subsequent semester. For as-

Principles of Theoretical Solid-State Physics. Fermi liquid theory. Electron-electron interaction. Variational methods. Magnetism. Superconductivity.

Intended learning outcomes

The students have basic knowledge of the theoretical description of solid-state phenomena. They know the corresponding mathematical or theoretical methods and are able to apply them to basic problems of solid-state theory and to understand the connections to experimental results. The individual students have elaborated on an advanced topic of solid-state theory and have discussed this topic in a seminar presentation.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2000

examination regulations) 2009.
Language of assessment: German, English
Allocation of places
Additional information
Workload
Teaching cycle



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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title Abbreviation			Abbreviation		
Experimental Particle Physics					11-TPE-092-m01
Module	Module coordinator			Module offered by	
Managing Director of the Institute of Applied Physics		Applied Physics	Faculty of Physics and Astronomy		
ECTS	CTS Method of grading Only after succ. co		mpl. of module(s)		
4	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate	Certain prerequisites must be met to qualify for admission to sessment. The lecturer will inform students about the respect at the beginning of the course. Registration for the course wi sidered a declaration of will to seek admission to assessment dents have obtained the qualification for admission to assess the course of the semester, the lecturer will put their registral sessment into effect. Students who meet all prerequisites will ted to assessment in the current or in the subsequent semesters and a later date, students will have to obtain the qualification to assessment anew.		ents about the respective details cion for the course will be connission to assessment. If stubracer admission to assessment over will put their registration for asset all prerequisites will be admite subsequent semester. For as-

Physics with modern particle detectors at the LHC and at the Tevatron. Discovery of the Higgs boson. Search for supersymmetry and other physics beyond the standard model. Determination of the top quark mass and W mass as well as other parameters of the standard model. Introduction to modern methods of analysis and assessment of systematic errors.

Intended learning outcomes

The students are familiar with the principles of modern particle detector physics, especially with currently open questions of Particle Physics, which are examined by using these detectors. They know modern methods of analysis and are able to put results into context and to assess their systematic uncertainties.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English
Allocation of places
Additional information
Workload
Teaching cycle



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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title Particle Physics (Standard Model)				Abbreviation
				11-TPS-092-m01
Module coordinator		Module offered by		
Managing Directors of the Institute of Applied Physics and the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy		
ECTS Met	nod of grading	Only after succ. con	Only after succ. compl. of module(s)	
8 num	erical grade		•	
Duration	Module level	Other prerequisites		
1 semester	graduate	sessment. The lecturation at the beginning of sidered a declaration dents have obtained the course of the sessment into effect ted to assessment it sessment at a later	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective deta at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment of the course of the semester, the lecturer will put their registration for a sessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For a sessment at a later date, students will have to obtain the qualification admission to assessment anew.	

Introduction to the theory of electroweak interaction and spontaneous symmetry breaking. Experiments on the standard model and determination of model parameters.

Intended learning outcomes

The students know the theoretical fundamental laws of the standard model of Particle Physics and the key experiments that have established and confirmed the standard model. They are able to interpret experimental or theoretical results in the framework of the standard model and know its validity and limits.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English



Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)



Module title Theory of Superconduction				Abbreviation
				11-TSL-092-m01
Module cod	rdinator		Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics		e of Theoretical Physics	Faculty of Physics and Astronomy	
ECTS Me	thod of grading	Only after succ. cor	Only after succ. compl. of module(s)	
5 nur	nerical grade			
Duration	Module level	Other prerequisites	Other prerequisites	
1 semester			nts about the respective details ion for the course will be consission to assessment. If sturadmission to assessment over will put their registration for astall prerequisites will be admites subsequent semester. For as-	

Introduction to the phenomenom of superconductivity. Microscopic theory of superconductivity (BCS theory). Phenomenological theory of superconductivity (Ginzburg-Landau theory). Mesoscopic aspects of superconductivity (Andreev scattering, Bobolioubov-de Gennes equation, SQUIDS). Quantum computing with superconductive elements.

Intended learning outcomes

The students have basic knowledge of the theoretical models for the description of superconductivity. They know the properties and application areas of these models and are able to apply calculation methods to simple problems.

Courses (type, number of weekly contact hours, language — if other than German)

R + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English
Allocation of places
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Additional information
-
Workload
-
Teaching cycle



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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)

Master's degree (1 major) FOKUS Physics (2011)