

Module Catalogue

for the Subject

Mathematical Physics

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

Examination regulations version: 2012 Responsible: Institute of Mathematics Responsible: Faculty of Physics and Astronomy

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record 88|b55|-|-|H|2012



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The subject is divided into

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Content and Objectives of the Programme

The Master programme Mathematical Physics is offered jointly by the Department of Mathematics and Computer Science and the Department of Physics and Astronomy.

The Master programme in Mathematical Physics is intended to provide the students with the following qualifications:

• capacity of abstraction,

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WÜRZBURG

- rigour in analytic reasoning,
- excellent capacity to realize the structure of complex interrelations,
- sound qualification in applying methods of Mathematics and Theoretical Physics to specific problems,
- insight into the intrinsic mathematical interdependence of different fields in Mathematics, Physics and Mathematical Physics as well as into interdisciplinary relations,
- specialisation in one field of mathematical physics during a one-year research project (so-called master project); the research project includes acquisition of the necessary specialized state-of-the-art knowledge and practical skills needed for independent research leading to the master thesis,
- high stamina in dealing with difficult problems,
- high capacity in problem solving,
- ability to carry out independent scientific work on a high level in research and implementation of mathematical physics,
- ability to cooperate responsibly within an interdisciplinary team of mathematicians, physicists and natural scientists,
- insight into and overview over current research in at least one field of contemporary mathematical physics,
- qualification for meeting the standards of a Ph.D. programme in Mathematics, Physics or Mathematical Physics (if applicable).

For the Master thesis the student works independently on a topic in Mathematical Physics and solves a problem within a limited time frame, following scientific criteria and applying established methods or modifying them if necessary.

The Masters exam ascertains that the candidate has a good overview in the field of Mathematical Physics and possesses the ability to use the corresponding scientific methods independently. The degree Master of Science in Mathematical Physics constitutes a further professional and scientific qualification.

Abbreviations used

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

12-Jul-2012 (2012-115)

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.



Compulsory Courses

(50 ECTS credits)

Module title			Abbreviation			
Analysi	Analysis and Geometry of Classical Systems			10-M=MP1-122-m01	L	
Module	e coord	inator		Module offered by		
Dean of	f Studi	es Mathematik (Mather	natics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semestergraduateCertain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective at the beginning of the course. Registration for the course will be sidered a declaration of will to seek admission to assessment. If dents have obtained the qualification for admission to assessment the course of the semester, the lecturer will put their registration sessment into effect. Students who meet all prerequisites will be ted to assessment in the current or in the subsequent semester. sessment at a later date, students will have to obtain the qualific admission to assessment anew.			as- tive details ll be con- nt. If stu- sment over tion for as- ill be admit- ster. For as- alification for			
Conten	ts					
Modern geomet tion to o geomet ty theor Recom Basic k is recor	Modern analytic methods (such as partial differential equations) and geometric methods (such as differential geometry) for the description of classical physics. Examples include movements of deformable bodies as reaction to outer load (deformation of elastic bodies, flow of a fluid, stream of a gas). Additional examples include geometric mechanics and symplectic geometry, classical field theory and classical gauge theory, general relativity theory. Recommended previous knowledge: Basic knowledge from the modules "Differential Geometry", "Introduction to Topology" and "Geometric Analysis"					
Intende	ed lear	ning outcomes		theid theory is user		
The stu masters	dent ga s advai	ains insight into moder nced techniques in this	n methods in mathema field and is able to ap	atics, which are appl ply them to complex	ied in classical phys problems.	ics. He/She
Course	S (type, r	umber of weekly contact hours	, language — if other than Ger	rman)	•	
V + Ü (r	no infor	mation on SWS (weekly	v contact hours) and co	ourse language avail	able)	
Methoo module is	d of ass creditab	sessment (type, scope, lang le for bonus)	uage — if other than German, e	examination offered — if no	it every semester, informati	on on whether
At the b examin minutes Langua	oeginni ation (s), c) o ge of a	ng of the course, the le approx. 90 to 120 minu ral examination in grou ssessment: German, Er	cturer will choose one tes; usually chosen), b ps of 2 candidates (ap nglish	of the following met) oral examination o prox. 30 minutes tot	hods of assessment: f one candidate eacl al)	a) written 1 (approx. 20
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wi	th 1 majo	r Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 9 / 184

Module appears in

Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics (2011)

Module	Module title			Abbreviation			
Algebra	Algebra and Dynamics of Quantum Systems			10-M=MP2-122-mo	1		
Module	e coord	inator		Module offered by	dule offered by		
Dean o	f Studi	es Mathematik (Mathe	matics)	Institute of Mathem	natics		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
10	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 semestergraduateCertain prerequisites must be met to qualify for admission sessment. The lecturer will inform students about the respect at the beginning of the course. Registration for the course v sidered a declaration of will to seek admission to assess medents have obtained the qualification for admission to assess the course of the semester, the lecturer will put their regist sessment into effect. Students who meet all prerequisites v ted to assessment in the current or in the subsequent seme sessment at a later date, students will have to obtain the q admission to assessment anew.		alify for admission to nts about the respec- ion for the course wi hission to assessmen r admission to asses will put their registra t all prerequisites wi e subsequent semes ave to obtain the qu) as- itive details Il be con- nt. If stu- ssment over ition for as- ill be admit- ster. For as- alification for				
Conten	ts						
Modern braic q Recom Basic k plex Ar	n algeb uantun mende nowleo nalysis"	raic methods for dynar n field theory, spectral d previous knowledge: dge from the modules ' ' is recommended. Bas	nics of quantum systen theory, symmetries and 'Functional Analysis", " ic knowledge of quantu	ns, e.g. operator alg l representation theo Introduction to Topo um mechanics is also	ebras with application ory. logy" and "Introduct o useful.	ons in alge- ion to Com-	
Intende	ed lear						
The stu master	ident g s advai	ains insight into mode nced techniques in this	rn methods in mathema s field and is able to ap	atics, which are appl ply them to complex	red in quantum phys problems.	ics. He/She	
Course	S (type, r	number of weekly contact hour	rs, language — if other than Ge	rman)			
V + Ü (r	no info	rmation on SWS (week	ly contact hours) and co	ourse language avail	able)		
Metho module is	d of ass s creditab	sessment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
At the t examin minute Langua	beginni nation (s), c) o nge of a	ng of the course, the le approx. 90 to 120 minu ral examination in grou ssessment: German, E	ecturer will choose one utes; usually chosen), b ups of 2 candidates (ap nglish	of the following met) oral examination o prox. 30 minutes tot	hods of assessment: f one candidate eacl al)	: a) written h (approx. 20	
Allocat	ion of j	olaces					
Additio	onal inf	ormation					
Workload							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master	's degr	ee (1 major) Mathemat	ical Physics (2012)				
Master's w	ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg ● ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 11 / 184	





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

Module title				Abbreviation	
Professional Specialization Mathematical Physics			11-FS-MP-122-m01		
Module	Module coordinator			Module offered by	
chairpe Physik	erson o (Mathe	f examination committee matical Physics)	Mathematische	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification f		
Conten	ts				
Introdu ned top	iction to bic of th	o current questions of a s ne Master's thesis. Summ	subdiscipline of Math nary of the required fu	ematical Physics wit undamental topics ir	h special relevance to the plan- a seminar presentation.
Intende	ed lear	ning outcomes			
The stu vance t able to	idents to the ii summ	have advanced knowledg ntended topic of the Mas arise their knowledge in a	ge of a current subdis ter's thesis. They kno an oral presentation.	cipline of Mathemat w the current state o	ical Physics with a special rele- of research in this area and are
Course	S (type, r	number of weekly contact hours, I	anguage — if other than Ger	rman)	
S (no ir	nformat	tion on SWS (weekly cont	act hours) and cours	e language available	e)
Metho module is	d of ass s creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether
talk wit Langua	th discu ige of a	ussion (approx. 30 to 45 i ssessment: German, Eng	ninutes) lish		
Allocat	ion of _l	olaces			
Additio	onal inf	ormation			
Worklo	ad				
Teaching cycle					
RETEFIED TO IN LPUT (examination regulations for teaching-degree programmes)					
Master	s dogr	us III ee (1 major) Mathematics	Del Physics (2012)		
master s uegree (1 major) mathematical Physics (2012)					

Module title				Abbreviation	
Scienti	Scientific Methods and Project Management Mathematical			Physics	11-MP-MP-122-m01
Module	coord	inator		Module offered by	
chairpe	rson o	f examination committee		Faculty of Physics a	ind Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as sessment into effect. Students who meet all prerequisites will be admir ted to assessment in the current or in the subsequent semester. For as sessment at a later date, students will have to obtain the qualification admission to assessment anew.		
Conten	ts				
Introdu questio	ction to ons of N	o the methods of scientifi Nathematical Physics. Wr	ic work, taking into a iting of a scientific pr	ccount methods of p oject plan for the pla	project planning. Application to anned Master's thesis.
Intende	ed learı	ning outcomes			
The stu thods o ster's th able to	dents l of a cur nesis. T descril	have knowledge of scient rent subdiscipline of Mat They are able to draft a pr be their projects in oral p	ific methods and me hematical Physics wi oject plan for the Ma resentations.	thodological work, in th special relevance ster's thesis and to p	ncluding project planning me- to the intended topic of the Ma- plan the required work. They are
Course	S (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)	
S (no in	Iformat	tion on SWS (weekly cont	act hours) and cours	e language available	<u>a)</u>
Methoo module is	l of ass creditab	eessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
talk wit Langua	h discı ge of a	ussion (approx. 30 to 45 r ssessment: German, Eng	ninutes) lish		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	Module appears in				
Master'	Master's degree (1 major) Mathematical Physics (2012)				

Module title			Abbreviation			
Study Group Mathematical Physics			11-MP-AG-122-m01			
Module	coord	inator		Module offered by		
chairpe Physik	erson o (Mathe	f examination committee matical Physics)	Mathematische	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Conten	ts					
Introdu area. Si	ction to ummar	o current questions of Ma y of the required fundam	athematical Physics a ental topics in a sem	s a preparation for a inar presentation.	Master's thesis in this research	
Intende	ed lear	ning outcomes				
The stu into cur	dents l rrent re	have advanced knowledg search topics. They are a	e of the subdisciplin ble to summarise the	e of Mathematical Pł eir knowledge in an o	nysics and have gained insights oral presentation.	
Courses	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
Arbeits weekly Arbeits weekly Arbeits weekly Arbeits kly conf Arbeits weekly Arbeits weekly Arbeits weekly Arbeits and Ap necessa Arbeits Ineory) Arbeits	Courses (type, number of weekly contact hours, language – if other than German) Mathematics Courses: Arbeitsgemeinschaft Algebra (Study Group Algebra): V (2 weekly contact hours) + S (2 weekly contact hours), German or English, once a year Arbeitsgemeinschaft Diskrete Mathematik (Study Group Discrete Mathematics): V (2 weekly contact hours) + S (2 weekly contact hours), German or English, available as necessary Arbeitsgemeinschaft Dynamische Systeme und Regelung (Study Group Dynamical Systems and Control): V (2 weekly contact hours) + S (2 weekly contact hours), German or English, available as necessary Arbeitsgemeinschaft Funktionentheorie (Study Group Complex Analysis): V (2 weekly contact hours) + S (2 weekly contact hours), German or English, available as necessary Arbeitsgemeinschaft Funktionentheorie (Study Group Geometry and Topology): V (2 weekly contact hours) + S (2 weekly contact hours), German or English, available as necessary Arbeitsgemeinschaft Mathematik in den Naturwissenschaften (Study Group Mathematics in the Sciences): V (2 weekly contact hours) + S (2 weekly contact hours), German or English, available as necessary Arbeitsgemeinschaft Mathematik in den Naturwissenschaften (Study Group Mathematics in the Sciences): V (2 weekly contact hours) + S (2 weekly contact hours), German or English, available as necessary Arbeitsgemeinschaft Maß und Integral (Study Group Measure and Integral): V (2 weekly contact hours) + S (2 weekly contact hours), German or English, available as necessary Arbeitsgemeinschaft Numerische Mathematik und Angewandte Analysis (Study Group Numerical Mathematics and Applied Analysis): V (2 weekly contact hours) + S (2 weekly contact hours), German or English, available as necessary Arbeitsgemeinschaft Robotik, Optimierung und Kontrolltheorie (Study Group Robotics, Optimisation and Control Theory): V (2 weekly contact hours) + S (2 weekly contact hours), German or English, available as necessary Arbeitsgemeinschaft Zahlentheorie (Study Group Number The					
Physics Arbeits mentor Arbeits contact Arbeits ber of w Arbeits contact Arbeits tion The lish	Physics courses: Arbeitsgemeinschaft Hopf-Algebren (Study Group Hopf Algebras): S (no set number of weekly contact hours, mentoring during study group sessions), German or English Arbeitsgemeinschaft Konforme Feldtheorie (Study Group Conformal Field Theory): S (no set number of weekly contact hours, mentoring during study group sessions), German or English Arbeitsgemeinschaft Moderne Differentialgeometrie (Study Group Modern Differential Geometry): S (no set num- ber of weekly contact hours, mentoring during study group sessions), German or English Arbeitsgemeinschaft Mathematische Physik (Study Group Mathematical Physics): S (no set number of weekly contact hours, mentoring during study group sessions), German or English Arbeitsgemeinschaft Mathematische Physik (Study Group Mathematical Physics): S (no set number of weekly contact hours, mentoring during study group sessions), German or English Arbeitsgemeinschaft Operatoralgebren und Darstellungstheorie (Study Group Operator Algebras and Representa tion Theory): S (no set number of weekly contact hours, mentoring during study group sessions), German or English					

Arbeitsgemeinschaft Quantenfeldtheorie (Study Group Quantum Field Theory): S (no set number of weekly contact hours, mentoring during study group sessions), German or English

Arbeitsgemeinschaft Riemannsche Geometrie (Study Group Riemannian Geometry): S (no set number of weekly contact hours, mentoring during study group sessions), German or English

Arbeitsgemeinschaft Symplektische und Poisson-Geometrie (Study Group Symplectic and Poisson Geometry): S (no set number of weekly contact hours, mentoring during study group sessions), German or English Arbeitsgemeinschaft Statistische Mechanik (Study Group Statistical Mechanics): S (no set number of weekly contact hours, mentoring during study group sessions), German or English

Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)

Mathematics Courses:

This module will be assessed by one or two of the following methods (to be selected by the lecturer at the beginning of the course):

• Topics covered in one lecture with seminar that is assigned to this module: presentation (60 to 180 minutes), written elaboration (approx. 5 to 30 pages), written examination (approx. 60 to 120 minutes), oral examination of one candidate each (approx. 15 to 20 minutes) or oral examination in groups of 2 candidates (approx. 20 to 30 minutes).

Language of assessment: German or English

Assessment will be offered in the semester in which the respective course is offered and in the subsequent semester; the courses will be available as necessary or every four semesters.

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. The lecturer may require that participants have previous knowledge and/or skills in certain areas and/or meet certain prerequisites (e.g. preparation of a written outline of their talk) to qualify for admission to assessment. Students will be informed about the details at the beginning of the course. Registration for the seminar will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment, the lecturer will put their registration for assessment into effect at the end of the course. If the lecturer selects two methods of assessment, the grades achieved in the two assessments will be equally weighted in the calculation of the module grade.

Physics courses:

This module will be assessed by a talk on the topics covered in the seminar and a discussion (approx. 30 to 45 minutes total).

Language of assessment German or English

Students must register for assessment online (details to be announced).

To pass this module, students must pass the assessment for the course they attended.

Allocation of places

Additional information

Workload

Teaching cycle

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

Module appears in

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

Master's with 1 major Mathematical Physics (2012)



Compulsory Electives

(40 ECTS credits)



Compulsory Electives Mathematics

(ECTS credits)



Advanced Mathematics

(ECTS credits)

Module title			Abbreviation		
Applied Analysis				10-M=AAAN-102-m01	
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 semestergraduateRegistration for the exercise must be made via SB@home at the beg ning of the course or as announced by the lecturer in accordance wit the specified registration deadlines. Certain prerequisites must be n to qualify for admission to assessment (e. g. successful completion certain percentage of exercises). The lecturer will inform students ab the respective details at the beginning of the course. Registration fo exercise will be considered a declaration of will to seek admission to 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 prerequ will be admitted to assessment in the current or in the subsequent s ster. For assessment at a later date, students will have to obtain the			de 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 f the course. Registration for the n of will to seek admission to as- qualification for admission to ester, the lecturer will put their re- udents who meet all prerequisites irrent or in the subsequent seme- dents will have to obtain the qua- new.		
In-dept theory particu theory Recom	th study of Hilbo llar FEN of ellip mende	y of functional analysis an ert spaces and Fourier an I methods), principles of tic, parabolic and hyperb d previous knowledge:	nd operator theory, S alysis, spectral theor functional analysis, f olic partial differentia	obolev spaces and p y and quantum mech unction spaces, emb al equations with me	partial differential equations, hanics, numerical methods (in pedding theorems, compactness, ethods from functional analysis.
Familia Intend	arity wit	h the contents of the mo	dule "Functional Ana	lysis" is strongly reco	ommended.
The stu to esta physics	ident is blish a s and o	acquainted with the fun- connection between his/ ther natural and enginee	damental notions, m 'her acquired skills a ring sciences.	ethods and results o nd other branches of	f higher analysis. He/She is able f mathematics and questions in
	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	- -
Metho module is	d of ass s creditab	rmation on SWS (weekly o sessment (type, scope, langua ile for bonus)	ge — if other than German, o	examination offered — if no	aDIE) t every semester, information on whether
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 exami- nation 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					
Worklo	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) 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)

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

Module title					Abbreviation	
Topics	in Alge	ebra			10-M=AALG-102-m01	
Modul	e coord	inator		Module offered by		
Dean c	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				
Durati	on	Module level	Other prerequisites			
1 semestergraduateRegistration for the exercise must be ma ning of the course or as announced by th the specified registration deadlines. Cert to qualify for admission to assessment (certain percentage of exercises). The lect the respective details at the beginning o exercise will be considered a declaration sessment. If students have obtained the assessment over the course of the seme gistration for assessment into effect. Stu will be admitted to assessment in the cu ster. For assessment at a later date, students			Ide via SB@home at the begine lecturer in accordance with tain prerequisites must be m (e.g. successful completion of turer will inform students about the course. Registration for n of will to seek admission to equalification for admission to ester, the lecturer will put their udents who meet all prerequision the subsequent sectors will have to obtain the of new	n- et out the as- to ir re- sites eme- qua-		
_			lification for admiss	ion to assessment a	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 is creditable for 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						
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						
reachi	ng cycl	e				
Master's w	/ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg ● ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische P	am. reg. da- page 22 / Physik - 2012	184

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

Module title				Abbreviation	
Differe	Differential Geometry			10-M=ADGM-102-m01	
Module	e coord	inator		Module offered by	<u> </u>
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	nester graduate 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 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 assessment. If students have obtained the qualification for admission to assessment into effect. Students who meet all prerequisities will be admitted to assessment in the current or in the subsequent set. For assessment at a later date, students will have to obtain the origination for admission to assessment anew.			de 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 arrent or in the subsequent seme- dents will have to obtain the qua- new.	
Conten	ts				
folds. Recomi Basic k metric A	mende nowlec Analysi	d previous knowledge: lge from the modules "In s" is recommended. ning outcomes	troduction to Differen	itial Geometry", "Inti	roduction to Topology" and "Geo-
The stu able to try.	dent is apply 1	acquainted with concep hese methods and know	ts and methods for d s about the interaction	ifferentiable manifol on of local and globa	ds or Riemannian manifolds, is Il methods in differential geome-
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + Ü (r	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Methoo module is	d of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
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 exami- nation 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.					
Allocat	ion of p	olaces			
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) Mathematical Physics (2012)

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

Module	e title				Abbreviation		
Complex Analysis					10-M=AFTH-102-m01		
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathema			atics)	Institute of Mathem	atics		
ECTS	Meth	od of grading	Only after succ. compl. of module(s)				
10	nume	rical grade					
Duratio	on	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 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 as- sessment. 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 prerequisites 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 qua-					
Conten	its th stud	y of mapping properties of	of analytic functions a	and their generalisat	ions with modern analytic and		
geome ons (e. Recom Basic k	geometric methods. Structural properties of families of holomorphic and meromorphic functions. Special functions (e. g. elliptic functions). Recommended previous knowledge:						
Intend	ed lear	ning outcomes					
The stu ticular betwee	ident is the (ge en his/l	acquainted with the fun ometric) mapping proper ner acquired skills and ot	damental notions, m ties of holomorphic f her branches of math	ethods and results o functions. He/She is nematics and applica	f higher complex analysis, in par- able to establish a connection ations in other subjects.		
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Gei	rman)			
V + Ü (I	no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)		
Metho module is	d of ass s creditab	sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, information on whether		
At the l examin nation Assess semest Langua	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 exami- nation 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)

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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)

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

Module title					Abbreviation	
Geome	tric Str	uctures			10-M=AGMS-102-mc	01
Module coordinator				Module offered by	Module offered by	
Dean of Studies Mathematik (Mathema			matics)	cs) Institute of Mathematics		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester		graduate	Registration for the ning of the course of the specified registr to qualify for admissi certain percentage of the respective detai exercise will be con sessment. If studen assessment over the gistration for assessi will be admitted to a ster. For assessmen	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 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 as- sessment. 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 prerequisites 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 qua-		
			lification for admiss	ion to assessment a	new.	
Tits buildings, generalised polygons or related geometric structures, automorphisms, BN pairs in groups, Mouf- ang conditions, classification results. Recommended previous knowledge: Basic knowledge from the modules "Introduction to Differential Geometry" and "Introduction to Topology" is re- commended.						
The stu	ident is	acquainted with the fi	undamental notions, m	ethods and results c	oncerning a type of g	eometric
structu about t	re. He/ he inte	She is able to establis ractions of geometry a	h a connection betweer nd other fields of math	n these results and b ematics.	roader theories, and	learns
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
1) Ü + V	no infoi	rmation on SWS (week	y contact hours) and co	ourse language avail	able)	
Metho module is	d of ass s creditab	eessment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informatio	on on whether
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 exami- nation in groups (groups of 2, approx. 30 minutes)						
Allocat	ion of I	olaces	<u> </u>			
Additional information						
Workload						
Teaching cycle						
Master's w	ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • ex- (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 28 / 184

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

Module title				Abbreviation			
Giovanni-Prodi Lecture (Master)					10-M=AGPC-102-m	 01	
Module coordinator				Madula offered by			
Dean of Studios Mathematik (Mathematics)			matics)	Institute of Mathematics			
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)			
5	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 semester graduate		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 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 as- sessment. 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 prerequisites 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 qua-				
Conter	ite	<u> </u>		ion to assessment a	new.		
Introdu	iction to	o a specialised topic ir	 mathematics by an int	ernational expert.			
Intend	ed lear	ning outcomes					
The stu themat themat	ident is tics. He tics and	acquainted with the f /She is able to establi I applications in other	undamental concepts a sh a connection betwee subjects.	nd methods of a cor n his/her acquired s	ntemporary research skills and other bran	topic in ma- ches of ma-	
Course	Courses (type, number of weekly contact hours, language — if other than German)						
V + Ü (I	no info	rmation on SWS (week	ly contact hours) and co	ourse language avail	able)		
Metho module is	d of ass s creditab	Sessment (type, scope, lan le for bonus)	guage — if other than German, e	examination offered — if no	ot every semester, informati	on on whether	
At the l examir nation Langua	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 exami- nation in groups (groups of 2, approx. 20 minutes) Language of assessment: English, German if agreed upon with the examiner						
Allocat	ion of j	olaces					
Additio	onal inf	ormation					
Worklo	ad						
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 w	ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg ● ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische F	am. reg. da- Physik - 2012	page 30 / 184	



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

Module title					Abbreviation	
Lie Theory					10-M=ALTH-102-m01	
Module coordinator				Module offered by		
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathematics		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester graduate		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 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 as- sessment. 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 prerequisites 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 qua-			
Conten	ts	L				
Recom Basic k mende useful.	Recommended previous knowledge: Basic knowledge of the contents of the modules "Functional Analysis" and "Introduction to Topology" is recom- mended. Furthermore, basic knowledge of the contents of the module "Introduction to Differential Geometry" is useful.					
The stu apply t ar alge	ıdent is hese to bra.	acquainted with the fun common problems, and	idamental results, the I knows about the inte	orems and methods eractions of group th	in Lie theory. He/She is able to eory, analysis, topology and line-	
Course	Courses (type, number of weekly contact hours, language — if other than German)					
V + Ü (r	no infoi	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Metho module is	d of ass s creditab	sessment (type, scope, langua le for bonus)	age — if other than German, e	examination offered — if no	t every semester, information on whether	
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 exami- nation 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						
Worklo	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) Mathematical Physics (2012)

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

Module	e title				Abbreviation		
Numeric of large Systems of Equations					10-M=ANGG-102-m	01	
Module coordinator			Module offered by				
Dean of	f Studi	es Mathematik (Mather	matics)	Institute of Mathematics			
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)			
10 numerical grade							
Duratio	n	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 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 as- sessment. 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 prerequisites 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 qua-					
Conten	ts						
Discreti	isation	of elliptic differential e		ation methods prec	onditioners multigr	id methods	
Recomr Basic ki and "Nu is also r Intende	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 mos	st effic	ient way to solve a give	n system of equations.				
V i Ü (n	S (type, r	reaction on SWS (wook)	s, language — if other than Ger	man) Nurso languago avail	abla)		
Method module is	d of ass creditab	sessment (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	abie) ot every semester, informati	ion on whether	
At the b examinant nation i Langua	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						
Allocati	ion of p	olaces					
Additio	nal inf	ormation					
Workload							
Teaching cycle							
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)			
Master's wit	ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • ex. (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 34 / 184	



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 title					Abbreviation		
Basics of Optimization					10-M=AOPT-102-m)1	
Madula conditator				Madula offered by			
Module coordinator			natics)	Institute of Mathematics			
FCTS	Mothe	ad of grading	Only after succ. com	Only after succ. compl. of module(s)			
to numerical grade							
Duratio	Duration Module level Other prerequisites						
1 semester graduate		Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be cons sessment. If student assessment over the gistration for assess will be admitted to a ster. For assessmen lification for admiss	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 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 as- sessment. 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 prerequisites 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 qua-				
Conten	ts						
Fundan mality, mics.	nental i restrict	methods and technique ted optimization, exam	es in continuous optim ples and applications i 	ization, unrestricted n natural and engine	optimization, condi eering sciences as w	tions for opti- ell as econo-	
The stu	dent ki	nows the fundamental ecide which method is	methods of continous of the most suitable in ar	optimization, can jud	lge their strengths a	nd weaknes-	
Course	S (type, n	umber of weekly contact hours	$\frac{1}{2}$ language — if other than Ger	man)			
V + Ü (r	no infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
Methoo module is	l of ass creditab	essment (type, scope, lang le for bonus)	uage — if other than German, e	examination offered — if no	t every semester, informati	on on whether	
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 exami- nation 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							
Allocat	ion of p	olaces					
Additional information							
Workload							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Master's wi	th 1 major	Mathematical Physics (2012)	JMU Würzburg ● ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 36 / 184	


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
Introdu	iction t	o Control Theory			10-M=ARTH-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. con	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 semester graduate		Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be con sessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessmen lification for admiss	exercise must be ma r as announced by th ation deadlines. Cer sion to assessment (of exercises). The lec ls at the beginning o sidered a declaration ts have obtained the e course of the seme sment into effect. Stu assessment in the cu t at a later date, stuc ion to assessment a	Ide 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 prerequisite urrent or in the subsequent seme dents will have to obtain the qua new.	
Conten	ts				
bility, b Recom Basic k Intende The stu blish a	mende nowled ed lear ident is connee	n optimal control. d previous knowledge: dge of the contents of the ning outcomes acquainted with the fun ction between these resu	e module "Ordinary D damental notions an lts and broader theor	ifferential Equations d methods of contro ries, and learns abou	" is useful. I theory. He/She is able to esta- ut the interactions of geometry
and otr	s (tupo r	as of mathematics.	anguago if other than Cou	(man)	
V + Ü (r	o info	rmation on SWS (weekly	contact hours) and co	urse language avail	ahle)
Methoo module is	d of ass creditab	Sessment (type, scope, langua ile for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether
written replace (groups Assess semest Langua	examined by an ed by an s of 2, a ment o cer, counge of a	nation (approx. 90 to 120 n oral examination of one approx. 30 minutes) ffered: Assessment offer ırse offered on demand o ssessment: German or E	e minutes); if announ e candidate each (app ed in the semester in r every four semester nglish	ced by the lecturer, t prox. 20 minutes) or which the course is s.	he written examination can be an oral examination in groups offered and in the subsequent
Allocat	ion of _l	olaces			
Additio	nal inf	ormation			
Worklo	Workload				
Teachi	ng cycl	e			

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

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

Master's with 1 major Mathematical Physics (2012)

Module title					Abbreviation
Stochas	stical F	Processes			10-M=ASTP-102-m01
Module	coord	inator		Module offered by	
Dean of	fStudie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semester graduate Regis ning the s to qu certa the r exerv sess asse gistr will h ster.		Registration for the end of the course of the specified registration for admission of the respective detail exercise will be consistent over the gistration for assessing will be admitted to a ster. For assessment for admission for assessment lifecation for admission f	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 he specified registration deadlines. Certain prerequisites must be met o qualify for admission to assessment (e.g. successful completion of a 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 as- sessment. 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 prerequisites 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 qua-		
Conten	te				new.
Markov	chaine	aueues stochastic pro	Cesses in C[0, 1] Brow	vnian motion Donsk	er's theorem projective limits
Recomr Basic k the con Intende The stu	mende nowlec tents c ed learn dent is	d previous knowledge: lge of stochastics is requ of the module "Stochastic ning outcomes acquainted with the func-	ired, such as that acc s 2" is also recomme damental notions and	quired in the "Stochanded. Inded. d methods of stocha	astics 1" module. Knowledge of stical processes and can apply
Course	practi	cal problems.			
V ± Ü (n	o infor	mation on SWS (weekly contact hours, i	contact hours) and co	nian) Nurse language avail	ahle)
Method module is	l of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
At the b examin nation i Langua	eginni ation (n grou ge of a	ng of the course, the lect 90 to 120 minutes), b) or ps (groups of 2, approx. ssessment: German, Eng	urer will choose one o al examination of one 30 minutes) lish	of the following metl candidate each (ap	hods of assessment: a) written prox. 20 minutes), c) oral exami-
Allocati	ion of p	olaces			
 Additio	nal inf	ormation			
Worklo	Workload				
Teachir	ng cvcl	e			
	5 - 9 - 1				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Mathematische Physik - 2012

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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		
Topolo	gy				10-M=ATOP-102-m	01
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathe	matics)	tics) Institute of Mathematics		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 semester graduate		Registration for the ning of the course o the specified registr to qualify for admiss certain percentage the respective detai exercise will be con sessment. If studen assessment over th gistration for assess will be admitted to ster. For assessmen lification for admiss	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 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 as- sessment. 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 prerequisites 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 qua-			
Conten	its	<u> </u>				
Set-the spaces	eoretic l	topology, topological ir ing spaces.	nvariants (e. g. fundam	ental group, connect	ion), construction of	topological
The stu	ed lean	ang outcomes	indomental results the	oroms and mothods	in topology and is a	bla to apply
these t	o comn	non problems.	inuamentai resuits, the	eorems and methods	s in topology and is a	inie io appiy
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V + Ü (I	no info	rmation on SWS (week	y contact hours) and co	ourse language avail	able)	
Metho module is	d of ass s creditab	sessment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
At the l examin nation Assess semest Langua	beginni nation (in grou ment o ter, cou age of a	ng of the course, the le 90 to 120 minutes), b) ps (groups of 2, approx ffered: Assessment off urse offered on demanc ssessment: German, E	ecturer will choose one oral examination of on k. 30 minutes) ered in the semester in l or every four semester nglish	of the following met e candidate each (ap which the course is rs.	hods of assessment prox. 20 minutes), c offered and in the s	: a) written :) oral exami- ubsequent
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	Workload					
Teachi	Teaching cycle					
Reierre	KETERFRED TO IN LPU I (examination regulations for teaching-degree programmes)					
Module	e appea	ars in				
Master's w	ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg ● ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 42 / 184



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) Computational Mathematics (2012)

Module title					Abbreviation						
Numbe	er Theo	ŷ			10-M=AZTH-102-mo	1					
Module	e coord	inator		Module offered by							
Dean o	f Studi	es Mathematik (Mathe	matics)	Institute of Mathematics							
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)							
10	nume	rical grade									
Duratio	on	Module level	Other prerequisites								
1 semester graduate		Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be con sessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessmen lification for admiss	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 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 as- sessment. 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 qua		the begin- ince with ust be met pletion of a lents about ation for the ssion to as- nission to put their re- prerequisites quent seme- tain the qua-						
Conton	te										
Recom Basic k on to A Intendo The stu structu into mo	mende mende lgebra' ed learn ident is res in r odern d	e development of mod d previous knowledge: dge of algebra and num f, "Introduction to Num ning outcomes acquainted with the fu number theory and kno evelopments in number	ern number theory. aber theory is assumed ber Theory" and "Appli undamental methods o ws methods for the sol er theory. s, language — if other than Gen	, such as can be acq ed Algebra". f analytics number th ution of diophantine	uired in the modules neory, can deal with a equations. He/She h	"Introducti- algebraic nas insight					
V + Ü (ı	no infoi	mation on SWS (week	y contact hours) and co	ourse language avail	able)						
Metho module is	d of ass s creditab	essment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informatic	on on whether					
At the l examir nation Assess semest Langua	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 exami- nation 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											
Additio	Additional information										
Worklo	ad										
Master's w	ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg ● ta record Master	generated 26-Aug-2024 • exa (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	aster's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012					

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)

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



Specialisation Mathematics

(ECTS credits)

Module	title				Abbreviation	
Selecte	d Topi	cs in Analysis			10-M=VANA-122-m01	
Module	coord	inator		Module offered by		
Dean of	fStudie	es Mathematik (Mathema	atics)	Institute of Mathematics		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for				
Conten	ts					
In-dept with otl Recom Depend doubt,	h discu ner mat mendeo ling on it is rec	ssion of a specialised to hematical concepts. d previous knowledge: the content, basic and a ommended to consult th	pic in analysis taking dvanced knowledge f e lecturer.	into account recent from different areas	developments and interrelations of analysis is required. In case of	
Intende	ed learr	ning outcomes				
The stu comple	dent is x probl	acquainted with advanc ems.	ed results in a selecte	ed topic in analysis,	and is able to apply these to	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + Ü (r	infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)	
Methoo module is	l of ass creditab	essment (type, scope, langua, le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
At the b examin minute Assess semest Langua	beginni ation (a s), c) oi ment o er, cou ge of a	ng of the course, the lect approx. 90 to 120 minute ral examination in groups ffered: Assessment offer rse offered on demand o ssessment: German, Eng	urer will choose one s; usually chosen), b s of 2 candidates (app ed in the semester in r every four semester lish	of the following met) oral examination o prox. 30 minutes tota which the course is s.	hods of assessment: a) written f one candidate each (approx. 20 al) offered and in the subsequent	
Allocat	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
Teachir	ng cycl	9				
Keierre	u (O IN	LFUI (examination regulations	s for teaching-degree progra	mmes)		

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

Module	Module title					
Algebra	aic Top	ology			10-M=VATP-102-mc	01
Module	e coord	inator		Module offered by		
Dean of	f Studi	es Mathematik (Mather	natics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be cons sessment. If student assessment over the gistration for assess will be admitted to a ster. For assessmen lification for admiss	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 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 as- sessment. 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 prerequisites 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 qua-			
Conton	+c				new.	
Recomr Basic k Intende The stu Courses V + Ü (n Method module is At the b examin minutes Langua	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 is creditable for 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. 20 minutes total)					opology". ion on whether : a) written h (approx. 20
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	Workload					
Teaching cycle						
 Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	e appea	irs in				
Master's wi	th 1 majo	r Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 49 / 184



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 I	Math	ematic			10-M=VDIM-102-mo	01		
Module c	oord	inator		Module offered by				
Dean of S	Studie	es Mathematik (Mather	natics)	Institute of Mathem	atics			
ECTS N	Neth	od of grading	Only after succ. con	Only after succ. compl. of module(s)				
5 n	numei	rical grade						
Duration		Module level	Other prerequisites	Other prerequisites				
1 semester graduate		Registration for the ning of the course of the specified registr to qualify for admissi certain percentage of the respective detai exercise will be con sessment. If studen assessment over th gistration for assessi will be admitted to a ster. For assessmen lification for admiss	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 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 as- sessment. 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 prerequisites 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 qua-					
Contents	I :							
Advancec graph the Recomme Basic kno Intended The stude Courses (V + Ü (no Method o module is cm At the beg examinat nation in Assessme semester Language	Contents 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 is creditable for bonus) At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (6o 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.					ion on whether : a) written oral exami- ubsequent		
Allocation	n of p	olaces						
Additiona	al info	ormation						
Workload								
Teaching	Teaching cycle							
Referred	to in	LPOI (examination regulation	ons for teaching-degree progra	ammes)				
Master's with :	1 major	Mathematical Physics (2012)	JMU Würzburg ● ta record Master	generated 26-Aug-2024 • exa (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 51 / 184		



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	e title				Abbreviation	
Dynam	ical Sy	stems and Control			10-M=VDSR-102-m01	
Module	e coord	inator		Module offered by		
Dean o	f 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				
Duratio	on	Module level	Other prerequisites			
1 semester graduate		Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be con- sessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessmen lification for admiss	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 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 as- sessment. 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 prerequisites 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 qua-			
Conten	its					
Recom Basic k Intende	mende nowled ed lear	d previous knowledge: dge of the contents of t ning outcomes	he module "Ordinary Di al methods in the theo	ifferential Equations ry of dynamic systen	" is useful. ns and control, and is able to	
	S (type, r	umber of weekly contact hour		rman)		
V + Ü (I	no info	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Metho module is	d of ass s creditab	sessment (type, scope, lang le for bonus)	guage — if other than German, o	examination offered — if no	ot every semester, information on whether	
At the l examin nation Assess semest Langua	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 exami- nation 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.					
Allocat	ion of _l	olaces				
Additional information						
Worklo	Workload					
Teachi	ng cycl	e				
Master's w	ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische P	am. reg. da- Physik - 2012	

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

Module	e title	<u>.</u>			Abbreviation		
Groups	and th	eir Representations			10-M=VGDS-102-m01		
		•					
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mathema		Institute of Mathem	natics		
ECIS	Metho	od of grading	Only after succ. compl. of module(s)				
10	nume	rical grade					
Duratio	on		Other prerequisites	Other prerequisites			
1 semester graduate		ning of the course o the specified registr to qualify for admiss certain percentage of the respective detai exercise will be cons sessment. If student assessment over the gistration for assess will be admitted to a ster. For assessmen lification for admiss	r as announced by the ation deadlines. Cer sion to assessment (of exercises). The lec- ls at the beginning of sidered a declaration ts have obtained the e course of the seme sment into effect. Stu- assessment in the cu- t at a later date, stud- ion to assessment a	he 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 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.			
Conten	ts						
Recomi Basic k "Applie Intende The stu rary res blems.	mende nowled ed Alge ed lear dent m search	d previous knowledge: dge of algebra is assume bra". ning outcomes nasters advanced algebra questions in group theor	d, such as can be acc aic concepts and meth y and representation	juired in the module nods. He/She gains theory and can appl	s "Introduction to Algebra" and the ability to work on contempo- y his/her skills to complex pro-		
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	man)			
V + Ü (r	no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)		
Method module is	d of ass creditab	Sessment (type, scope, langua le for bonus)	age — if other than German, e	examination offered — if no	ot every semester, information on whether		
At the k examin minute Assess semest Langua	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						
Allocat	Allocation of places						
			-				
Additio	nal inf	ormation	_				
Worklo	ad						

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) Nanostructure Technology (2011)

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

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

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

Module title					Abbreviation	
Geome	trical N	Nechanics			10-M=VGEM-102-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)) Institute of Mathematics		
ECTS	ECTS Method of grading Only after succ. cor			npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be con- sessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessmen lification for admiss	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 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 as- sessment. 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 qua			
Conten	ts					
grange Recome ge of th Intende The stu knows Course V + Ü (r	Introduction to geometric mechanics: basic notions of differential geometry and symplectic geometry, Euler-La- grange 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. Knowled- ge 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)					
Method module is	d of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether	
At the t examin minute Assess semest Langua	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.					
Allocat	Allocation of places					
Additio	Additional information					
Worklo	ad					

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) Mathematical Physics (2012)

Module	title				Abbreviation
Aspects	s of Ge	ometry			10-M=VGEO-102-m01
Module	coord	inator		Module offered by	
Dean of	fStudi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semester graduate Regist ning of the sp to qua certain the re exerci sessm asses gistrat will be ster. F		Registration for the e ning of the course of the specified registra- to qualify for admiss certain percentage of the respective detail exercise will be cons- sessment. If student assessment over the gistration for assess will be admitted to a ster. For assessment lification for admissi	exercise must be ma r as announced by the ation deadlines. Cer- sion to assessment (of exercises). The lec- ls at the beginning of sidered a declaration is have obtained the e course of the seme ment into effect. Stu- ussessment in the cu- t at a later date, stuc- ion to assessment a	de 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 irrent or in the subsequent seme- dents will have to obtain the qua- new	
Conten	ts				
In-dept with oth	h discu ner ma	ussion of a special type o thematical structures, e.	f geometry taking into g. topological geome	o account recent dev tries, diagram geom	velopments and interrelations etries.
Recomr Basic k	nende	d previous knowledge: lge from the modules "Di	fferential Geometry"	and "Introduction to	Topology" is recommended.
Intende	ed leari	ning outcomes			
The stu comple	dent is x prob	acquainted with advanc lems.	ed results in a selecte	ed field of geometry	and can apply his/her skills to
Courses	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + Ü (n	no infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)
Method module is	l of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
At the b examin nation i Langua	oeginni ation (in grou ge of a	ng of the course, the lect 60 to 90 minutes), b) ora ps (groups of 2, approx. 3 ssessment: German, Eng	urer will choose one l examination of one 20 minutes) lish	of the following metl candidate each (app	hods of assessment: a) written prox. 15 minutes), c) oral exami-
Allocati	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ng cycl	e			
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)	



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

Module	Module title							
Giovan	ni-Proc	li Lecture Selected Top	ics (Master)		10-M=VGPC-122-m	01		
Module	e coord	inator		Module offered by				
Dean o	f Studi	es Mathematik (Mathe	matics)	Institute of Mathem	natics			
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)				
10 numerical grade								
Duratio	on	Module level	Other prerequisites	i				
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of sidered a declaratio dents have obtained the course of the se sessment into effec ted to assessment i sessment at a later admission to asses	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.					
Conten	ts							
Introdu	iction t	o a specialised topic in	mathematics by an int	ernational expert.				
Intende	ed lear	ning outcomes						
The stu themat themat Course V + Ü (r Methoo module is At the k examin minute Assess semest Langua	dent is ics. He ics and s (type, r no infor d of ass s creditab beginni hation (s), c) o ment o ter, cou age of a	acquainted with the fu /She is able to establis applications in other mation on SWS (week) cessment (type, scope, lang le for bonus) ng of the course, the le approx. 90 to 120 minu- ral examination in grou ffered: Assessment off rse offered on demance ssessment: English, Gu	undamental concepts a sh a connection betwee subjects. s, language — if other than Ge ly contact hours) and co guage — if other than German, ecturer will choose one utes; usually chosen), b ups of 2 candidates (ap fered in the semester in l or every four semester erman if agreed upon w	Ind methods of a content his/her acquired series in his/her acquired series	able) tevery semester, information hods of assessment f one candidate each al) offered and in the se	topic in ma- ches of ma- ion on whether : a) written h (approx. 20 ubsequent		
Allocat	ion of _l	olaces						
Additio	onal inf	ormation						
Worklo	ad							
Teachi	ng cycl	e						
Referred to in LPO I (examination regulations for teaching-degree programmes)								
			,					
Module	e appea	urs in						
Master	's degr	ee (1 major) Mathemat	ics (2012)					
Master	's degr	ee (1 major) Mathemat	ical Physics (2012)					
Master	's degr	ee (1 major) Computati	onal Mathematics (201	2)				
Master's wi	ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 61 / 184		

Module title					Abbreviation	
Basics in Mathematics					10-M=VGRM-102-m	.01
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathema			atics) Institute of Mathematics			
ECTS	Metho	od of grading	Only after succ. com	Only after succ. compl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		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 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 as- sessment. 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 prerequisites 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 qua-			
Conten	te				new.	
Discuss and phi	sion of losopł	problems and question	s on the foundation of	mathematics, apply	ing methods of set t	heory, logic:
Intende	d lear	ning outcomes				
The stu	dent is	acquainted with the fo	undational methods ir	mathematics and lo	ogic.	
Courses	5 (type, n	umber of weekly contact hours	, language — if other than Ger	rman)		
V + Ü (n	o infor	mation on SWS (weekly	/ contact hours) and co	ourse language avail	able)	
Method module is	Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)					
At the b examin nation i Langua	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						
Additio	nal inf	ormation				
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) Mathematical Physics (2012)						
master	s uegro	ee (1 major) watnematio				
iviaster's wit	aster's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012 page 62 / 184					

Module title					Abbreviation			
Mathematical Continuum Mechanics				10-M=VKOM-122-m	101			
Module coordinator				Module offered by				
Dean of Studies Mathematik (Mathema			natics)	atics) Institute of Mathematics				
ECTS Method of grading			Only after succ. com	Only after succ. compl. of module(s)				
5	nume	rical grade						
Duratio	on	Module level	Other prerequisites	Other prerequisites				
1 semester		graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.					
Conten	ts							
Partial differential equations and/or variational methods in the context of continuum mechanics. Recommended previous knowledge: Basic knowledge from the modules "Ordinary Differential Equations" and "Introduction to Partial Differential Equations" is recommended, as well as basic knowledge of functional analysis. Intended learning outcomes The student masters the mathematical methods in mathematical continuum mechanics 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 is creditable for 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)								
semest	ter, cou	rse offered on demand ssessment: German. Ei	or every four semester in or every four semester	s.	onered and in the si	ubsequent		
Allocat	ion of p	places						
Additional information Workload								
Teaching cycle								
Referred to in LPO I (examination regulations for teaching-degree programmes)								
Module appears in								
Master's wi	Master's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012 page 63 / 184							

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

Module title					Abbreviation		
Mathematical Imaging 10-M=VMBV-102-m01							
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathema		atics)	Institute of Mathem	atics			
ECTS Method of grading		Only after succ. compl. of module(s)					
5	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 semester graduate		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 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 as- sessment. 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 prerequisites 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 qua- lification for admission to as-				
Conter	te						
camera models and camera calibration, rigid and non-rigid registration, reconstruction of 3D objects from came- ra 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 recommen- ded.							
The student masters the mathematical methods in the theory of image processing and knows about their main fields of application.							
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	rman)			
V + Ü (i	no infoi	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)		
Metho module i	d of ass s creditab	sessment (type, scope, langua le for bonus)	age — if other than German, o	examination offered — if no	t every semester, information on whether		
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 exami- nation in groups (groups of 2, approx. 20 minutes) Language of assessment: German, English							
Allocation of places							
Additional information							
Workload							
Teaching cycle							
Master's w	ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg ● ta record Master	generated 26-Aug-2024 • exa (120 ECTS) Mathematische P	am. reg. da- hysik - 2012		

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

Module title					Abbreviation		
Selected Topics in Mathematical Physics					10-M=VMPH-102-m01		
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathema		natics)	Institute of Mathem	natics			
ECTS Method of grading			Only after succ. con	Only after succ. compl. of module(s)			
5	nume	rical grade					
Duration Module level		Other prerequisites	i i				
1 semester graduate		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 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 as- sessment. 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 prerequisites 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 qua-				
			lification for admiss	ion to assessment a	new.		
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.							
Course	S (type, 1	number of weekly contact hour	s, language — if other than Ge	rman)			
V + Ü (I	no info	rmation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written							
nation 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							
Teachi	ng cycl	e					
Master's w	Aaster's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012 page 67 / 184						

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

Module title					Abbreviation	
Modul Theory 10-M=VMTH-102-m01						
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathema			atics) Institute of Mathematics			
ECTS Method of grading			Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	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 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 as- sessment. 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 prerequisites 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 qua-			
Conter	its					
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.						
V + Ü (no info	rmation on SWS (weekly	contact hours) and co	ourse language availa	able)	
Metho module i	d of ass s creditab	Sessment (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether	
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 exami- nation 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)						
			-			
Master's w	ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg •	generated 26-Aug-2024 • exa	am. reg. da- busile acce	
ta record Master (120 ECIS) Mathématische Physik - 2012						



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

Master's with 1 major Mathematical Physics (2012)

Module title					Abbreviation	
Non-Linear Analysis					10-M=VNAN-102-m01	
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathema			atics)	tics) Institute of Mathematics		
ECTS	ECTS Method of grading Only after succ. compl. of modul			pl. of module(s)		
5	nume	rical grade				
Duratio	n	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 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 as- sessment. 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 prerequisites 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 qua-				
Conten	ts				new.	
Method	ls in no	onlinear analysis (e. g. to	ological methods, m	onotony and variation	onal methods) with applications.	
Recommended previous knowledge: We recommend basic knowledge of functional analysis and partial differential equations, such as can be acqui- red in the modules "Introduction to Functional Analysis" and "Applied Analysis". Intended learning outcomes						
bility or	n practi	cal problems.				
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + Ü (n	io infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)	
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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 exami- nation in groups (groups of 2, approx. 20 minutes) Language of assessment: German, English						
Allocation of places						
Additional information						
Workload						
Teaching cycle						
KETERFED TO IN LPU I (examination regulations for teaching-degree programmes)						

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Mathematische Physik - 2012

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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 title					Abbreviation	
Numeri	Numeric of Partial Differential Equations10-M=VNPE-102-m01					01
Module coordinator Module offered b			Module offered by			
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semestergraduateRegistration for the exercise must be made via SB@home at the bring of the course or as announced by the lecturer in accordance the specified registration deadlines. Certain prerequisites must bring of the course of 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 admissi assessment over the course of the semester, the lecturer will put gistration for assessment into effect. Students who meet all prere will be admitted to assessment in the current or in the subsequer ster. For assessment at a later date, students will have to obtain the semester.			the begin- ance with ust be met pletion of a dents about ation for the ission to as- mission to l put their re- prerequisites equent seme- tain the qua-			
			lification for admiss	ion to assessment a	new.	
Recomm We reco red in t Intende The stu Course	mende ommer he moo ed lear ident is s (type, r	d previous knowledge: ad basic knowledge of fu dules "Introduction to Fu hing outcomes acquainted with advance number of weekly contact hours,	nctional analysis and nctional Analysis" an ced methods for discr language – if other than Ger	partial differential e d "Applied Analysis" etising partial differe	quations, such as ca ential equations.	an be acqui-
V + Ü (r	no info	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Method module is	d of ass creditab	sessment (type, scope, languale for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	ion on whether
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 exami- nation 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						
 Worklo	ad		-			
Naster's wi	Aster's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012 page 73 / 184					

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) Nanostructure Technology (2010) Master's degree (1 major) Nanostructure Technology (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 title				Abbreviation		
Optimal Control				10-M=VOST-102-m	01	
Module	e coord	inator		Module offered by		
Dean of Studies Mathematik (Mathematics) Instit			Institute of Mathem	natics		
ECTS	Methe	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 semestergraduateRegistration for the exercise must be made via SB@home at the ning of the course or as announced by the lecturer in accordance the specified registration deadlines. Certain prerequisites must to qualify for admission to assessment (e. g. successful complet certain percentage of exercises). The lecturer will inform studen the respective details at the beginning of the course. Registration exercise will be considered a declaration of will to seek admiss sessment. If students have obtained the qualification for admis assessment over the course of the semester, the lecturer will pre will be admitted to assessment in the current or in the subsequ ster. For assessment at a later date, students will have to obtain			the begin- ance with ust be met pletion of a dents about ration for the ission to as- mission to l put their re- prerequisites equent seme- tain the qua-			
Cantan	4-	<u> </u>			new.	
optima Recom We rec quired the cor Intendo The stu rary res Course V + Ü (n Methoo module is	Desires 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					can be ac- nowledge of n contempo- ion on whether
At the l examir nation Langua	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					
Additional information						
Workload						
Teachi	Teaching cycle					
	1					
Master's w	aster's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012					

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

Module title				Abbreviation		
Quantum Control and Quantum Computing					10-M=VQKC-102-m	01
Module	e coord	inator		Module offered by		
Dean of Studies Mathematik (Mathematics)			natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semestergraduateRegistration for the exercise must be made via SB@home at th ning of the course or as announced by the lecturer in accordand the specified registration deadlines. Certain prerequisites must to qualify for admission to assessment (e.g. successful compl certain percentage of exercises). The lecturer will inform studed the respective details at the beginning of the course. Registrat exercise will be considered a declaration of will to seek admission sessment. If students have obtained the qualification for admis assessment over the course of the semester, the lecturer will p gistration for assessment into effect. Students who meet all pr will be admitted to assessment at a later date, students will have to obtain			the begin- ance with ust be met pletion of a dents about ation for the ission to as- mission to l put their re- prerequisites equent seme- tain the qua-			
Conton	+c					
Contents 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 is creditable for bonus) At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (6o 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.				ger equation, nsional spin g. in quantum es the ability chanics. on on whether a) written oral exami- ubsequent		
Allocat	ion of p	olaces				
Additio	Additional information					
Workload						
Teachi	Teaching cycle					
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	ammes)		
Master's wi	ith 1 majoi	r Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • exa (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 77 / 184



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 (2010) Master's degree (1 major) Mathematical Physics (2012)

Module	title				Abbreviation	
Statisti	ical Ana	alysis			10-M=VSTA-102-mc)1
Module	coord	inator		Module offered by		
Dean of	f Studie	es Mathematik (Mather	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade		•		
Duratio	n	Module level	Other prerequisites			
1 semestergraduateRegistration for the exercise must be made via SB@home at the begining of the course or as announced by the lecturer in accordance with 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 a the respective details at the beginning of the course. Registration for exercise will be considered a declaration of will to seek admission to 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 prerequired will be admitted to assessment in the current or in the subsequent			the begin- ance with ust be met pletion of a dents about ation for the ission to as- mission to l put their re- prerequisites equent seme- tain the qua-			
			lification for admiss	ion to assessment a	new.	tani tile qua
Conten	ts					
Conting crimina Recomr Basic k	gency ta int func mendeo nowlec	ables, categorical regre tion analysis, cluster a d previous knowledge: lge of stochastics is reg	ssion, one-factorial van nalysis, principal comp quired, such as that acc	riance analysis, two- oonent analysis, fact quired in the "Stocha	factorial variance an or analysis. astics 1" module. Kno	alysis, dis- owledge of
the con		aing outcomes		indea.		
The stu	dent is	acquainted with the fu	Indamental methods in	statistical analysis	and can apply them	to practical
Course	S (type, n	umber of weekly contact hour	5, language — if other than Ger	man)		
V + Ü (r	no infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	l of ass creditab	essment (type, scope, lang le for bonus)	uage — if other than German, e	examination offered — if no	t every semester, informati	on on whether
At the b examin nation i Langua	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					
Allocat	ion of p	olaces				
Additio	nal info	ormation				
Workload						
Teachir	Teaching cycle					
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	mmes)		
Master's wi	th 1 major	Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 79 / 184



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	
Networked Systems					10-M=VVSY-102-m01
Module	coord	inator		Module offered by	
Dean of	fStudie	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme:	ster	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 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 th exercise will be considered a declaration of will to seek admission to as sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their r 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 qu		Ide 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 irrent or in the subsequent seme- dents will have to obtain the qua-
Conten	ts		lification for admiss	ion to assessment a	new.
Contem system	iporary s); ana	topics in networked line lysis of control-theoretica	ar and non-linear dyr al aspects (controllab	namical systems (ho ility, accessibility, e	mogenous and non-homogenous tc.).
Recomr Basic k	nende nowlec	d previous knowledge: Ige of the contents of the	module "Ordinary Di	fferential Equations	" is useful.
Intende	ed learı	ning outcomes			
The stu on cont	dent is empor	acquainted with advanc ary research questions ir	ed methods in the fien networked systems.	ld of networked sys	tems. He gains the ability to work
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Methoo module is	l of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
At the b examin nation i Langua	oeginni ation (in grou ge of a	ng of the course, the lect 60 to 90 minutes), b) ora ps (groups of 2, approx. 2 ssessment: German, Eng	urer will choose one l examination of one 20 minutes) lish	of the following met candidate each (app	hods of assessment: a) written prox. 15 minutes), c) oral exami-
Allocat	ion of p	olaces			
Additio	Additional information				
Worklo	Workload				
 T					
Teachir	Teaching cycle				
	ما هم اس		6		
Keterre	a to in	LPUI (examination regulations	s for teaching-degree progra	mmes)	



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



Seminars Mathematics

Module title				Abbreviation	
Seminar in Applied Differential Geometry				10-M=SADG-102-m01	
Module	e coordi	inator		Module offered by	
Dean o	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate	te Registration for the seminar 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. 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	c in applied differential g	geometry.		
Recomi Advanc Geome "Pseud	mendeo ed kno try". Kn o-Riem	d previous knowledge: wledge of differential geo owledge of the contents annian and Riemannian	ometry is required, su of the modules "App Geometry" and "Lie T	ich as can be acquir lied Differential Geo heory" is also recom	ed in the module "Differential metry", "Geometric Mechanics", mended.
Intende	ed learr	ning outcomes			
The stu the top	dent is ic and t	able to elaborate a conte the available literature, p	emporary research to reparing a talk and th	pic. This includes co ne ability to participa	mprehending and structuring of ate in a scientific discussion.
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
S (no ir	nformat	ion on SWS (weekly cont	act hours) and course	e language available	e)
Method module is	d of ass creditab	essment (type, scope, langua;	ge — if other than German, e	examination offered — if no	t every semester, information on whether
At the t minar p sentation Assess semest Langua	beginni bresenta on of a ment o cer, cou ge of a	ng of the course, the lect ation (approx. 60 to 120 to oprox. 60 to 90 minutes ffered: Assessment offer rse offered on demand o ssessment: German, Eng	urer will choose one o minutes), b) written e ed in the semester in r every four semester lish	or two of the followin laboration of conter which the course is s.	ng methods of assessment: a) se- nts equivalent to a seminar pre- offered and in the subsequent
Allocat	ion of p	olaces			
Additio	nal info	ormation			
worklo	Workload				
Referre					
Module	Module appears in				
Master	's degre	ee (1 major) Mathematics	(2012)		
Master	's degre	ee (1 major) Mathematics	(2010)		
Master	Master's degree (1 major) Mathematical Physics (2012)				

Module title				Abbreviation	
Seminar in Algebra 10-M=SALG-102-m01				10-M=SALG-102-m01	
Module coordinator			Module offered by		
Dean of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS Methe	od of grading	Only after succ. con	npl. of module(s)		
5 nume	rical grade				
Duration	Module level	Other prerequisites			
1 semester graduate Registration for the semina ning of the course or as an specified registration dead ly be open for students with areas. Where applicable, d		seminar must be ma r as announced by th n deadlines. Some s nts with previous kn able, details will be	de via SB@home at the begin- ne lecturer in accordance with the seminars or workshops might on- owledge and/or skills in certain specified in the class schedule.		
Contents					
A modern top Recommende Basic knowlee "Applied Alge	ic in algebra. d previous knowledge: dge of algebra is assumed bra".	d, such as can be acc	quired in the module	s "Introduction to Algebra" and	
Intended lear	ning outcomes				
The student is the topic and	s able to elaborate a cont the available literature, p	emporary research to reparing a talk and t	pic. This includes co he ability to participa	omprehending and structuring of ate in a scientific discussion.	
Courses (type,	number of weekly contact hours, l	anguage — if other than Ger	rman)		
S (no informa	tion on SWS (weekly cont	act hours) and cours	e language available	e)	
Method of as module is creditat	s essment (type, scope, langua ble for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether	
At the beginn minar present sentation of a Assessment of semester, cou Language of a	ing of the course, the lect tation (approx. 60 to 120 pprox. 60 to 90 minutes offered: Assessment offer urse offered on demand o assessment: German, Eng	urer will choose one minutes), b) written e ed in the semester in r every four semester :lish	or two of the followin elaboration of conter which the course is 's.	ng methods of assessment: a) se- nts equivalent to a seminar pre- offered and in the subsequent	
Allocation of	places				
Additional inf	ormation				
Workload					
Teaching cycle					
Referred to in LPOL (ovamination regulations for teaching degree programmes)					
	NEIGHTER TO THE LEVEL (examination regulations for teaching-degree programmes)				
Master's dear	ree (1 major) Mathematics	5 (2012)			
Master's degr	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	
Seminar in Dynamical Systems and Control				10-M=SDSR-102-m01	
Module	e coord	inator		Module offered by	
Dean o	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semester graduate Registration for the seminar must be made via SB@home at the ning of the course or as announced by the lecturer in accordance specified registration deadlines. Some seminars or workshops m ly be open for students with previous knowledge and/or skills in areas. Where applicable, details will be specified in the class sci			de via SB@home at the begin- ne lecturer in accordance with the eminars or workshops might on- owledge and/or skills in certain specified in the class schedule.		
Conten	ts				
A mode	ern topi mende	c in dynamical systems a d previous knowledge:	and control.	ntrol Theory," or "Cou	stral Theory " is required
KIIOWIE	uge of				ittot meory is required.
The stu the top	dent is	able to elaborate a cont the available literature, p	emporary research to reparing a talk and tl	pic. This includes co ne ability to participa	mprehending and structuring of ate in a scientific discussion.
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
S (no ir	format	ion on SWS (weekly cont	act hours) and cours	e language available	2)
Metho	d of ass	sessment (type, scope, langua	ge — if other than German, e	examination offered — if no	t every semester, information on whether
module is	creditab	le for bonus)	-		
At the t minar p sentati Assess semest Langua	beginni oresent on of a ment o er, cou ge of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 90 minutes ffered: Assessment offer rse offered on demand o ssessment: German, Eng	urer will choose one minutes), b) written e ed in the semester in r every four semester lish	or two of the followin elaboration of conter which the course is s.	ng methods of assessment: a) se- nts equivalent to a seminar pre- offered and in the subsequent
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teaching cycle					
Referred to in LPOL (examination regulations for teaching degree programmes)					
Module	20002	ore 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	
Seminar in	Complex Analysis			10-M=SFTH-102-m01	
Module coo	rdinator		Module offered by		
Dean of Stu	dies Mathematik (Mathem	atics)	Institute of Mathem	natics	
ECTS Me	thod of grading	Only after succ. con	npl. of module(s)		
5 nur	nerical grade				
Duration	Module level	Other prerequisites			
1 semester graduate		Registration for the ning of the course o specified registratio ly be open for stude areas. Where applic	seminar must be ma r as announced by th n deadlines. Some s nts with previous kn able, details will be	de via SB@home at the begin- ne lecturer in accordance with the seminars or workshops might on- owledge and/or skills in certain specified in the class schedule.	
Contents					
A modern to Recommen Basic know recommenc	opic in complex analysis. ded previous knowledge: ledge of the contents of the led.	e modules "Introducti	on to Complex Analy	rsis" and " Complex Analysis" is	
Intended le	arning outcomes				
The studen the topic ar	is able to elaborate a cont d the available literature, p	emporary research to preparing a talk and t	pic. This includes co he ability to participa	omprehending and structuring of ate in a scientific discussion.	
Courses (typ	e, number of weekly contact hours,	language — if other than Gei	rman)		
S (no inforn	nation on SWS (weekly con	tact hours) and cours	e language available	2)	
Method of a module is credi	issessment (type, scope, langua table for bonus)	age — if other than German,	examination offered — if no	t every semester, information on whether	
At the begin minar prese sentation o Assessmen semester, o Language o	nning of the course, the lect entation (approx. 60 to 120 f approx. 60 to 90 minutes t offered: Assessment offer ourse offered on demand of f assessment: German. Eng	turer will choose one minutes), b) written e red in the semester in or every four semester glish	or two of the followir elaboration of conter which the course is 's.	ng methods of assessment: a) se- nts equivalent to a seminar pre- offered and in the subsequent	
Allocation	of places	5			
Additional	nformation				
Workload					
Teaching cycle					
Referred to	in LPO I (examination regulation	is for teaching-degree progra	mmes)		
Module apr	ears 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	
Seminar in Geometry and Topology				10-M=SGMT-102-m01	
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semestergraduateRegistration for the seminar must be made via SB@home at the ning of the course or as announced by the lecturer in accordanc specified registration deadlines. Some seminars or workshops ly be open for students with previous knowledge and/or skills in areas. Where applicable, details will be specified in the class so			de via SB@home at the begin- ne lecturer in accordance with the eminars or workshops might on- owledge and/or skills in certain specified in the class schedule.		
Conten	ts				
A mode Recom Basic k pology	ern topi mende nowlec ' is reco	c in geometry and topolo d previous knowledge: lge of the contents of the ommended.	gy. modules "Introducti	on to Differential Geo	ometry" and "Introduction to To-
Intende	ed lear	ning outcomes			
The stu the top	dent is ic and	able to elaborate a conte the available literature, p	emporary research to reparing a talk and th	pic. This includes co ne ability to participa	mprehending and structuring of ate in a scientific discussion.
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	man)	
S (no ir	nformat	ion on SWS (weekly cont	act hours) and cours	e language available)
Method module is	d of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
At the t minar p sentati Assess semest	beginni present on of a ment o cer, cou ge of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 90 minutes ffered: Assessment offered rse offered on demand o ssessment: German, Eng	urer will choose one minutes), b) written e ed in the semester in r every four semester lish	or two of the followir elaboration of conter which the course is s.	ng methods of assessment: a) se- nts equivalent to a seminar pre- offered and in the subsequent
Allocat	ion of r	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teaching cycle					
Peferred to in LPO L (examination regulations for teaching degree areas made)					
	RETENENT TO THE LEVEL (examination regulations for teaching-degree programmes)				
Module					
Master	's degr	ee (1 major) Mathematics	(2012)		
Master	's degr	ee (1 major) Mathematics	s (2010)		
Master	's degr	ee (1 major) Mathematica	l Physics (2012)		

Module title				Abbreviation	
Giovann	i-Prod	i Seminar (Master)			10-M=SGPC-102-m01
Module	coord	nator		Module offered by	
Dean of	Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	numei	rical grade			
Duration	1 I	Module level	Other prerequisites		
1 semester graduate Registration for the semin ning of the course or as ar specified registration dea ly be open for students wi		seminar must be ma r as announced by th n deadlines. Some s nts with previous kn able, details will be	de via SB@home at the begin- ne lecturer in accordance with the eminars or workshops might on- owledge and/or skills in certain specified in the class schedule.		
Content	s				
A moder	'n topi	c in the research expertis	se of the current hold	er of the Giovanni Pr	odi Chair.
Intended	d learr	ning outcomes			
The stud the topic	lent is c and t	able to elaborate a conte he available literature, p	emporary research to reparing a talk and th	pic. This includes co ne ability to participa	mprehending and structuring of ate in a scientific discussion.
Courses	(type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
S (no inf	format	ion on SWS (weekly cont	act hours) and cours	e language available	2)
Method	of ass	essment (type, scope, langua;	ge — if other than German, e	examination offered — if no	t every semester, information on whether
module is o	creditab	le for bonus)			
At the be minar pr sentatio Languag	eginni resenta n of aj ge of a	ng of the course, the lect ation (approx. 60 to 120 f oprox. 60 to 90 minutes ssessment: English, Gerr	urer will choose one minutes), b) written e nan if agreed upon w	or two of the followir elaboration of conter ith the examiner	ng methods of assessment: a) se- nts equivalent to a seminar pre-
Allocatio	on of p	laces			
Addition	nal info	ormation			
Workloa	d				
Teaching	g cycl	9			
Referred	l to in	LPOI (examination regulations	for teaching-degree progra	mmes)	
Module appears in					
Master's	Master's degree (1 major) Mathematics (2012)				
Master's	Master's degree (1 major) Mathematics (2010)				
Master's	s degre	ee (1 major) Economathei	matics (2011)		
Master's	s degre	ee (1 major) Mathematica	al Mathematics (2012)		
Master's degree (1 major) Computational Mathematics (2012)					

Interdisciplinary Seminar 10-M=SIDZ-102-m01 Module coordinator Module offered by Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s) 5 numerical grade Duration Module level Other prerequisites 1 semestr 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 by be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule. Contents Some seminary outcomes Some seminary outcomes on a scientific discussion. Course (rps, number of week) contact hours, language – if other than Geman) Some seminary outcomes of the available literature, preparing a talk and the ability to participate in a scientific discussion. Course (rps, number of week) contact hours, language – if other than Geman) Some seminary outcomes on a scientific discussion. Some information on SWS (weekly contact hours) and course language available. Method of assessment: geninary of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 6o to a com minutes), b) written elaboration of contents equivalent to a seminar presentation (approx. 6o to a poiminutes)	Module title				Abbreviation	
Module offered by Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Methed of grading Only after succ. com U of module(s) Some succed and the sum of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might on ty be open for students with previous knowledge and/or skills in certain areas. Where application deadlines. Some seminars or workshops might on ty be open for students with previous knowledge and/or skills in certain areas. Where application deadlines. Some seminars or workshops might on ty be open for students with previous knowledge and/or skills in certain areas. Where application deadlines. Some seminars or workshops might on ty be open for students with previous knowledge and/or skills in certain areas. Where application deadlines. Some seminars or workshops might on ty be open for students with previous knowledge and/or skills in certain areas. Where application deadlines. Some seminars or workshops might on ty be open for students with previous knowledge and/or skills in certain areas. Where application deadlines. Some seminars or workshops might on ty be open for students with previous knowledge and/or skills in certain areas. Where application deadlines. Some seminars or workshops might on ty be open for students with previous knowledge and/or skills in certain areas. Where application deadlines. Some seminars or workshops might on the subalbel literature, preparing a talk and the ability to participate in a scientific discussion. Courset Institute of washed or subsets (weekly contact hours, language – if other than German, examination offered – if not every semester, information or syms (op on minutes). By written elab	Interdis	sciplina	ary Seminar			10-M=SIDZ-102-m01
Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s) 5 numerical grade Duration Module level Other precupisites I 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 Intended learning outcomes 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, language – if other than German) S (no information on SWS (weekly contact hours, language – if other than German) S At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 6o to 30 minutes), b) written elaboration of contents equivalent to a seminar presentation of approx. 6o to 30 minutes), b) written elaboration of contents equivalent to a seminar presentation (approx. 6o to 30 minutes), b) written elaboration for tentes equivalent to a sem	Module	coord	inator		Module offered by	
ECTS Method of grading Only after succ. compl. of module(s) 5 numerical grade Duration Module level Other prerequisites 1 sematrical 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. Content	Dean of	fStudie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
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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	5	nume	rical grade			
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 A modern topic in mathematics with interdisciplinary aspects. Intended learning outcomes 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 is celtable for bonus) At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation of approx. 6 to 120 minutes), b) written elaboration of contents equivalent to a seminar presentation of places - Additional information - - Workload - - Module appears in Mathematics (2012) Master's degree (1 majo	Duratio	n	Module level	Other prerequisites		
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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 is creditable for bonus) At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) seminar presentation (approx. 6o to 20 minutes), b) written elaboration of contents equivalent to a seminar pre- sentation of approx. 6o to 90 minutes Language of assessment: German, English Allocation of places	Intende	ed learn	ning outcomes			
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 is creditable for 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 90 minutes Language of assessment: German, English Allocation of places	The stu the topi	dent is ic and t	able to elaborate a conte the available literature, p	emporary research to reparing a talk and th	pic. This includes co ne ability to participa	omprehending and structuring of ate in a scientific discussion.
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 is creditable for 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 90 minutes Language of assessment: German, English Allocation of places Additional information Workload Teaching cycle Referred to in LPO 1 (examination regulations for teaching-degree programmes) Module appears in Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Economathematics (2011)	Courses	5 (type, n	umber of weekly contact hours, la	anguage — if other than Ger	man)	
Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for 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 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) Economathematics (2011) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Economathematics (2012)	S (no in	format	ion on SWS (weekly cont	act hours) and cours	e language available	2)
module is creditable for 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 90 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 (2011)	Method	l of ass	essment (type, scope, langua	ge — if other than German, e	examination offered — if no	t every semester, information on whether
At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) se- minar presentation (approx. 6o to 120 minutes), b) written elaboration of contents equivalent to a seminar pre- sentation of approx. 6o to 90 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) Economathematics (2011) Master's degree (1 major) Economathematics (2012)	module is	creditab	le for bonus)			
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) Economathematics (2011) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematics (2011) Master's degree (1 major) Mathematics (2011)	At the b minar p sentatio Langua	eginni oresent on of a ge of a	ng of the course, the lect ation (approx. 60 to 120 p pprox. 60 to 90 minutes ssessment: German, Eng	urer will choose one minutes), b) written e lish	or two of the followir elaboration of conter	ng methods of assessment: a) se- nts equivalent to a seminar pre-
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 (2011) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012)	Allocati	ion of p	olaces			
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)						
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) Economathematics (2012)	Additio	nal info	ormation			
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) Economathematics (2012)						
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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)						
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)	Teachir	ng cycl	9			
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)		<u> </u>				
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)	Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)	
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) 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 appears in					
Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012)	Master'	s degre	ee (1 major) Mathematics	(2012)		
Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012)	Master'	Master's degree (1 major) Mathematics (2010)				
Master's degree (1 major) Mathematical Physics (2012)	Master'	s degre	ee (1 major) Economathe	matics (2011)		
Masteria degree (1 major) Mathematical EnySits (2012)	Master'	s degre	ee (1 major) Mathematica	Il Physics (2012)	-)	
master's degree (1 major) computational mathematics (2012)	master	s aegre	ee (1 major) computation	at mathematics (201	2)	

Module	e title				Abbreviation	
Semina	Seminar in Numerical Mathematics and Applied Analysis				10-M=SNMA-102-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade		•		
Duratio	n	Module level	Other prerequisites			
1 semester graduate Registration for the seminar must be made via SB@homening of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course or as announced by the lecturer in account of the course of the course or as announced by the lecturer in account of the course of the cour			de via SB@home at the begin- ne lecturer in accordance with the seminars or workshops might on- owledge and/or skills in certain specified in the class schedule.			
Conten	ts					
A mode Recom Depend themat	ern topi mende ding on ics is re	c in numerical mathemat d previous knowledge: the content, basic and a equired. In case of doubt	tics or applied analys dvanced knowledge , it is recommended t	is. from different areas o consult the lecture	of analysis and/or numerical ma- er.	
Intende	ed lear	ning outcomes				
The stu the top	ident is ic and	able to elaborate a cont the available literature, p	emporary research to reparing a talk and th	pic. This includes co ne ability to participa	mprehending and structuring of ate in a scientific discussion.	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
S (no ir	nformat	tion on SWS (weekly cont	act hours) and cours	e language available	2)	
Method module is	d of ass s creditab	sessment (type, scope, langua le for bonus) ng of the course the lect	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
minar p sentati Langua	oresent on of a ige of a	ation (approx. 60 to 120 pprox. 60 to 90 minutes ssessment: German, Eng	lish	laboration of conter	its equivalent to a seminar pre-	
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in					
Master	's degr	ee (1 major) Mathematics	s (2012)			
Master	Master's degree (1 major) Mathematics (2010)					
Master	's degr	ee (1 major) Economathe	matics (2011)			
Master	's degr	ee (1 major) Mathematica	a Mathematics (2012)	2)		

Module title		Abbreviation			
Seminar in Mathematics in the Sciences				10-M=SMNW-122-m01	
Module coor	dinator		Module offered by		
Dean of Stud	lies Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS Met	hod of grading	Only after succ. com	npl. of module(s)		
5 num	erical grade				
Duration	Module level	Other prerequisites			
1 semester	1 semester graduate Registration for the seminar must be made via SB@home at the b ning of the course or as announced by the lecturer in accordance specified registration deadlines. Some seminars or workshops mi ly be open for students with previous knowledge and/or skills in c areas. Where applicable, details will be specified in the class sch			de via SB@home at the begin- ne lecturer in accordance with the eminars or workshops might on- owledge and/or skills in certain specified in the class schedule.	
Contents					
A modern to	pic in mathematics in the s	sciences.			
Basic knowl Equations" i	edge from the modules "Or s recommended, as well as	rdinary Differential Ec s basic knowledge of	quations" and "Introc functional analysis.	duction to Partial Differential	
Intended lea	rning outcomes				
The student the topic and	is able to elaborate a cont d the available literature, p	emporary research to preparing a talk and th	pic. This includes co he ability to participa	mprehending and structuring of ate in a scientific discussion.	
Courses (type	, number of weekly contact hours, l	anguage — if other than Ger	man)		
S (no inform	ation on SWS (weekly cont	act hours) and cours	e language available	e)	
Method of a module is credit	ssessment (type, scope, langua able for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
At the begin minar presensentation of Assessment semester, co Language of	ning of the course, the lect ntation (approx. 60 to 120 approx. 60 to 90 minutes offered: Assessment offer ourse offered on demand o assessment: German, Eng	urer will choose one minutes), b) written e ed in the semester in r every four semester (lish	or two of the followin elaboration of conter which the course is 's.	ng methods of assessment: a) se- nts equivalent to a seminar pre- offered and in the subsequent	
Allocation o	fplaces				
Additional in	formation				
Workload					
Teaching cycle					
Referred to i	n LPO I (examination regulation	s for teaching-degree progra	mmes)		
Module appears in					
Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)					

Module	title				Abbreviation	
Semina	r in Op	timization		10-M=SOPT-102-m01		
Module coordinator				Module offered by		
Dean of	fStudie	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme:	ster	graduate	Registration for the s ning of the course o specified registratio ly be open for stude areas. Where applic	seminar must be ma r as announced by th n deadlines. Some s nts with previous kn able, details will be	de via SB@home at the begin- ne lecturer in accordance with the seminars or workshops might on- owledge and/or skills in certain specified in the class schedule.	
Conten	ts					
A mode	ern topi	c in optimisation.				
Intende	ed leari	ning outcomes				
The stu the top	dent is ic and	able to elaborate a content of the available literature, p	emporary research to reparing a talk and th	pic. This includes co he ability to participa	omprehending and structuring of ate in a scientific discussion.	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)		
S (no in	format	ion on SWS (weekly cont	act hours) and cours	e language available	e)	
Methoo module is	d of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
At the b minar p sentation Assession semest Langua	beginni oresent on of a ment o er, cou ge of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 90 minutes ffered: Assessment offer rse offered on demand o ssessment: German, Eng	urer will choose one minutes), b) written e ed in the semester in r every four semester lish	or two of the followin elaboration of conter which the course is 's.	ng methods of assessment: a) se- nts equivalent to a seminar pre- offered and in the subsequent	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module appears in						
Master	's degr	ee (1 major) Mathematics	(2012)			
Master	Master's degree (1 major) Mathematics (2010)					
Master	's degr	ee (1 major) Economathe	matics (2011)			
Master	's degr	ee (1 major) Mathematica	ll Physics (2012)			
Master	's degr	ee (1 major) Computation	al Mathematics (201	2)		



Learning by Teaching Mathematics

Module title					Abbreviation	
Learning by teaching Mathematics 1					10-M=ELT1-102-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studio	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Superv	ising a	tutorial or study group in	the Bachelor's progr	amme under guidan	ce of the respective lecturer.	
Intende	ed leari	ning outcomes				
The stu methoo	dent ga Is and	ains his/her first experier can apply them in practic	nce in teaching unive al situations.	rsity mathematics. H	le/She knows basic didactical	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
Ü (no ir	nformat	tion on SWS (weekly cont	act hours) and cours	e language available	e)	
Methoo module is	d of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
practica Langua	al exam ge of a	nination (approx. 90 minu ssessment: German, Eng	utes) lish			
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	Module appears in					
Master	's degr	ee (1 major) Mathematics	5 (2012)			
Master	's degr	ee (1 major) Mathematics	(2010)			
Master's degree (1 major) Mathematical Physics (2012)						



Compulsory Electives Physics





Solid State Physics

Module title					Abbreviation		
Theoret	Theoretical Solid State Physics						
Module	coord	inator		Module offered by	lodule offered by		
Managi and Ast	Managing Director of the Institute of Theoretical Physics Faculty of Phys and Astrophysics				nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	ıpl. of module(s)			
8	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semester		graduate	Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later admission to assess	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Content	ts						
Principl thods. I	es of T Nagnet	heoretical Solid-State F tism. Superconductivity	Physics. Fermi liquid th	eory. Electron-electro	on interaction. Varia	tional me-	
Intende	d learr	ning outcomes					
The stur respond theory a an adva	dents h ding ma and to anced t	nave basic knowledge c athematical or theoretic understand the connec opic of solid-state theo	of the theoretical descr cal methods and are al tions to experimental r ry and have discussed	iption of solid-state ble to apply them to results. The individua this topic in a semir	phenomena. They kr basic problems of sc al students have elal nar presentation.	now the cor- blid-state porated on	
Courses	5 (type, n	umber of weekly contact hours	, language — if other than Ger	rman)			
R + V (n	o infor	mation on SWS (weekly	v contact hours) and co	ourse language availa	able)		
Method module is	l of ass creditab	e essment (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether	
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.							
Allocati	ion of p	olaces					
Additional information							
Workload							
Teaching cycle							
Referre	d to in	LPOI (examination regulation	ons for teaching-degree progra	mmes)			
Master's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012 page 98 / 1					page 98 / 184		



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

Module title					Abbreviation	
Theore	Theoretical Solid State Physics 2 11-TFK2-111-m01					
Module	e coord	inator		Module offered by		
Manag and As	ing Dire trophys	ector of the Institute of Th sics	neoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semestergraduateCertain 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 assessmer dents have obtained the qualification for admission to assess the course of the semester, the lecturer will put their registration sessment into effect. Students who meet all prerequisites wited to assessment in the current or in the subsequent semester sessment at a later date, students will have to obtain the qualification.			alify for admission to as- nts about the respective details ion for the course will be con- hission to assessment. If stu- r admission to assessment over will put their registration for as- t all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for			
Conten	ts		1			
 a) metal-insulators and topological insulators b) transport phenomena c) magnetic impurities in metals. Kondo effect and heavy fermions d) electron-phonon interaction e) one-dimensional conductors Intended learning outcomes The students have advanced knowledge of the theoretical description of solid-state phenomena. They know the mathematical or theoretical methods and are able to apply them to problems of solid-state theory and understand the connections to experimental results. The individual students have elaborated on an advanced topic of						
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	rman)		
V + R (r	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Method module is	d of ass creditab	Sessment (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether	
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						
Allocat	Allocation of places					
Additional information						
Worklo	ad					

Teaching cycle

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

Module appears in

Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Nanostructure Technology (2010) 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) FOKUS Physics (2006)

Master's with 1 major Mathematical Physics (2012)

Module	e title				Abbreviation	
Theory of Superconduction					11-TSL-092-m01	
Module	e coord	inator		Module offered by		
Managi and Ast	ing Dire trophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate C s a s d t t s t e s		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anow.				
Conten	ts		<u>.</u>			
Introdu Phenon vity (An elemen	ction to nenolo Idreev s	o the phenomenom of su gical theory of supercond scattering, Bobolioubov-d	perconductivity. Micr luctivity (Ginzburg-La de Gennes equation,	roscopic theory of su Indau theory). Mesos SQUIDS). Quantum o	perconductivity (BCS theory). scopic aspects of superconducti- computing with superconductive	
Intende	ed lear	ning outcomes				
The stu the pro blems.	dents l perties	have basic knowledge of and application areas of	the theoretical mode f these models and a	ls for the description re able to apply calcu	n of superconductivity. They know ulation methods to simple pro-	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
R + V (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
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.						
Allocation of places						
Additional information						
Worklo	Workload					
Teachir	ng cycl	e				

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

Module appears in

Module	Module title				Abbreviation	
Renorm	Renormalization Group Methods in Field Theory				11-RMFT-102-m01	
Module	coord	inator		Module offered by		
Managi and Ast	Managing Director of the Institute of Theoretical Physics F and Astrophysics				nd Astronomy	
ECTS Method of grading Only after succ. compl. of module(s)						
6 numerical grade						
Duratio	n	Module level	Other prerequisites			
1 semester graduate Certain p sessmer at the be sidered a dents ha the cour sessmer ted to as sessmer		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	ertain prerequisites must be met to qualify for admission to as- essment. The lecturer will inform students about the respective details t the beginning of the course. Registration for the course will be con- idered a declaration of will to seek admission to assessment. If stu- lents have obtained the qualification for admission to assessment over he course of the semester, the lecturer will put their registration for as- essment into effect. Students who meet all prerequisites will be admit- ed to assessment in the current or in the subsequent semester. For as- essment at a later date, students will have to obtain the qualification for dmission to assessment anew.			
Conten	ts					
Renorm analyse	alisati ed beha	on group methods for no aviour of cryogenic temp	on-linear partial differ eratures.	ential equations, fiel	d theoretical contex	ts and non-
Intende	ed learı	ning outcomes				
The stu of the r	dents ន្ត enorma	gain an overview of non- alisation group method.	linearities in partial d	ifferential equations	and their solution o	n the basis
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	man)		
V + R (n	o infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Methoo module is	l of ass creditab	essment (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	t every semester, informat	ion on whether
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.					amination in nutes) or c) esentation sessment demic and	
Allocat	ion of p	olaces	<u> </u>			
Additional information						
Workload						
Teaching cycle						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	appea	irs in				
Master's wi	th 1 major	Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 104 / 184



Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Mathematical Physics (2012) 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 (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2010)

Module title					Abbreviation	
Renorm	nalizati	ion Theory	11-RNT-092-m01			
Module	e coord	inator		Module offered by		
Managi and Ast	ing Dire trophys	ector of the Institute of T sics	heoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for				
Conten	ts	L				
behavio levance ons. Sto berg-Ma and con Intende The stu	our for e for ph ochast a differ mparis ed lear dents	dynamics beyond the ec ase diagrams in cryoger ic non-linear partial diffe rential equations. Symm on of different RG metho ning outcomes have gained an overview ow important examples	guilibrium. Classical-c nic temperatures. Inst erential equations. Co etries, e.g. in the stoc ds.	ritical and quantum- ability of statistical a nstruction of general hastic Burgers' equa	erential equations with scaling critical phenomena and their re- and dynamic mean-field soluti- ting functionals. Halperin-Hohen- ation (KPZ equation). Introduction	
tasks.					are able to apply them to specific	
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	rman)		
R + V (n	io infor	mation on SWS (weekly	contact hours) and co	ourse language availa	able)	
module is	1 of ass s creditab	Sessment (type, scope, langua Ile for bonus)	age — if other than German,	examination offered — if no	ot every semester, information on whether	
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						
Additio	nal inf	ormation				
Worklo	ad		_			

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) 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) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Module title					Abbreviation
Many Body Quantum Theory					11-QVTP-092-m01
Module	e coord	inator		Module offered by	
Managi and Ast	ing Dire trophys	ector of the Institute of Tl sics	heoretical Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
8	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Conten	ts	<u> </u>		Sment unew.	
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					
Intende	ed lear	ning outcomes			
The stu ply the	dents l acquir	have mastered the princi ed methods to current pr	ples of quantum field oblems of Theoretica	l theory in many-part l Solid-State Physics	icle systems. They are able to ap-
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	rman)	
R + V (n	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	age — if other than German, o	examination offered — if no	t every semester, information on whether
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					
Additio	nal inf	ormation			
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 (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) 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 (2010)

Module title				Abbreviation		
Relativistic Effects in Mesoscopic Systems				11-RMS-092-m01		
Module	Module coordinator M					
Managi and Ast	ng Dire rophys	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	Ind Astronomy	
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 graduate		Certain prerequisite sessment. The lectur at the beginning of t sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew			
Conten	ts					
Relativi logical	stic eff insulat	ects in mesoscopic sys ors Majorana fermior	stems Spin-orbit coup	oling Dirac equatio	n Quantum Hall ef	fect Topo-
Intende	ed learı	ning outcomes				
The stu especia	dents l Illy in t	nave mastered the mat he field of mesoscopic	hematical methods for physics. They are able	the description of re to apply their knowl	elativistic quantum s edge to simple syste	ystems, ems.
Courses	5 (type, n	umber of weekly contact hour	s, language — if other than Gei	rman)		
R + V (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Method module is	l of ass creditab	s essment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informati	ion on whether
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.						amination in nutes) or c) esentation sessment demic and
Allocati	ion of p	olaces	<u> </u>			
Additional information						
Workload						
Teaching cycle						
KETEFIED TO IN LPUT (examination regulations for teaching-degree programmes)						
 Module appears in						
module	ahhea					
Master's wi	Master's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012					page 110 / 184



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		
Electro	Electron Electron Interaction					
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire rophys	ector of the Institute of Th ics	eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester		graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.			
Conten	ts					
1. Introc teractio thod of dels. 10	duction n). 4. l functio . Impu	n, systems, Landau theor ntroduction to boson pha onal integrals. 7. Renorm rities in Luttinger liquids	y2. Interacting electro ase fields and interac alisation groups.8. Co	on gas. 3. One-dimen tions. 5. Calculation onsideration of spin.	sional electron gas of correlation functi 9. One-dimensiona	(without in- ons. 6. Me- l lattice mo-
Intende	d learr	ning outcomes				
The sturn on.	dents	know the principles of the	e theoretical descript	ion of electron-electi	ron interactions in o	ne dimensi-
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)	
Method module is	l of ass creditab	e essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, informati	on on whether
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.						
Allocati	ion of p	olaces				
Additional information						
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
waster's wit	aster's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012 page 112 / 184					



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 (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2006)

Module	title				Abbreviation	
Field Th	neory i	n Solid State Physics			11-FTFK-112-m01	
Module	e coord	inator		Module offered by		
Managi and Ast	ing Dire trophys	ector of the Institute of Th sics	neoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semestergraduateCertain prerequisites must be met to qualify for admission to a sessment. The lecturer will inform students about the respectivation at the beginning of the course. Registration for the course will 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 registration sessment into effect. Students who meet all prerequisites will ted to assessment at a later date, students will have to obtain the qualification to assess			alify for admission to as- nts about the respective details ion for the course will be con- nission to assessment. If stu- r admission to assessment over will put their registration for as- t all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for			
Conten	ts		L			
This will usually be a course on quantum many particle physics using the method of functional integration. An outline could be: 1 Coherent states and review of second quantization 2 The functional integral formalism at finite temperatures T 3 Perturbation theory at T=0 4 Order parameters and broken symmetry 5 Green's functions 6 The Landau theory of Fermi liquids						
Intende	ed lear	ning outcomes	·			
The stu ply the	dents l acquir	have mastered the princi ed methods to current pr	ples of quantum field oblems of Theoretica	theory in many-part Solid-State Physics	icle systems. They are able to ap-	
Courses	S (type, r	number of weekly contact hours, I	anguage — if other than Ger	man)		
V + R (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methoc module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
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 oramination regulations) approx						
Allocation of places						
Additional information						
Worklo	ad					

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) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Nanostructure Technology (2010) 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) FOKUS Physics (2006)



Astro Physics and Particle Physics

(ECTS credits)

Module title					Abbreviation	
Quantum Mechanics II 11-QM2-092-m01						
Module	Module coordinator M					
Manag and As	ing Dire trophys	ector of the Institute of ⁻ sics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites	i		
1 semester undergraduate		undergraduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anow.			
Conten	ts					
Contents "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.						
dents.						
Course	S (type, r	number of weekly contact hours	s, language — if other than Ge	rman)		
R + V (r	no infor	mation on SWS (weekly	/ contact hours) and co	ourse language avail	able)	
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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						
Master's w	laster's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012 page 117 / 184					

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

Module title				Abbreviation		
Theory of Relativity					11-RTT-092-m01	
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire rophys	ector of the Institute of ⁻ sics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	ıpl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to according to a set the subsequent semester.			
Conten	ts					
Mathen ments o general	natical of diffe relativ	foundations of the theo rential geometry; electr ity; stellar models; intr	ory of relativity; different odynamics as an exam oduction to cosmology	ntial forms; brief sun ple of a relativistic g ; Hamiltonian formu	nmary of special rela auge theory; field ec lation	itivity; ele- quations of
Intende	ed learr	ning outcomes				
The stu mathen able to	dents a natical apply t	are familiar with the bas understanding of the fo he acquired knowledge	sic physical and mathe ormulation of general r e to problems of Astrop	matical concepts of elativity on the basis hysics and cosmolo	general relativity. Th of differential forms gy.	ey have a 5. They are
Courses	5 (type, n	umber of weekly contact hours	, language — if other than Ger	man)		
R + V (n	o infor	mation on SWS (weekly	contact hours) and co	urse language availa	able)	
Method module is	l of ass creditab	e essment (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether
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.						
Allocati	ion of p	olaces				
Additional information						
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wi	th 1 major	Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • exa (120 ECTS) Mathematische Pl	am. reg. da- hysik - 2012	page 119 / 184

Module title				Abbreviation		
General Theory of Relativity					11-ART-112-m01	
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire trophys	ector of the Institute of ⁻ sics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later admission to assess	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Conten	ts		1			
Mathen ments o general	natical of diffe relativ	foundations of the theo rential geometry; electr ity; stellar models; intro	ory of relativity; differe odynamics as an exam oduction to cosmology	ntial forms; brief sun ple of a relativistic g ; Hamiltonian formu	nmary of special rela auge theory; field ec lation	itivity; ele- quations of
Intende	ed learı	ning outcomes				
The stu mathen able to	dents a natical apply 1	are familiar with the bas understanding of the fo the acquired knowledge	sic physical and mathe ormulation of general r e to problems of Astrop	matical concepts of elativity on the basis physics and cosmolo	general relativity. Th of differential forms gy.	ey have a s. They are
Courses	S (type, n	umber of weekly contact hours	, language — if other than Ger	man)		
V + R (n	o infor	mation on SWS (weekly	contact nours) and co	ourse language availa	able)	
module is	creditab	le for bonus)	uage — If other than German, o	examination offered — If no	t every semester, informati	on on whether
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						
Allocati	ion of p	olaces				
Additional information						
Workload						
Teaching cycle						
Peferred to in IPO I (evamination regulations for teaching degree programmer)						
Reference to III LFOT (examination regulations for teaching-degree programmes)						
Master's wi	Master's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012 page 121 / 184					page 121 / 184



Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) 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) FOKUS Physics (2006)

Module title Abbreviation						
Special	Special Theory of Relativity				11-SRT-112-m01	
Module	Module coordinator Mod					
Managi and Ast	ng Dire trophys	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		graduate	Certain prerequisite sessment. The lectu at the beginning of sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew		
Conten	ts					
Mathen nian eq	natical uation	principles; differential of motion; relativistic	forms; special relativit free particle	y; Minkowski space;	Lorentz transformat	tion, Hamilto-
Intende	ed lear	ning outcomes	·			
The stu familia ge to pi	dents a r with n roblem	are familiar with the ph nodern mathematical f s of special relativity.d	nysical concepts and m formulation of special r en.	athematical principle elativity. They are ab	es of special relativit le to apply the acqui	y. They are red knowled-
Course	S (type, r	number of weekly contact hour	rs, language — if other than Ge	rman)		
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	l of ass creditab	sessment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
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 oramination regulations)						
Allocat	ion of p	olaces				
Additional information						
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
module	appea	us III				
Master's wi	Aaster's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012 page 123 / 184					



Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) 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) FOKUS Physics (2006)

Module	Module title				Abbreviation	
Group 1	Group Theory				11-GRT-092-m01	
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire trophys	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment it sessment at a later admission to assess	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.			
Conten	ts					
Group t	heory.	Finite groups. Lie grou	ps. Lie algebra. Depicti	on. Tensors. Classifi	cation theorem. App	lications.
Intende	ed learı	ning outcomes				
The stu group t lation a	dents l heory a ind pro	know the basics of grou and to solve them by us cessing of physical pro	up theory, especially of sing the acquired methooblems.	Lie groups. They are ods. They are able to	able to identify prol apply group theory	blems of to the formu-
Course	S (type, n	number of weekly contact hour	rs, language — if other than Ger	rman)		
R + V (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	l of ass creditab	sessment (type, scope, lang le for bonus)	guage — if other than German, o	examination offered — if no	t every semester, informat	ion on whether
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.						
Allocat	ion of p	olaces				
Additional information						
Workload						
Teaching cycle						
Poferred to in LPO L (maximum station for the Line for th						
 Module appears in						
Master's with 1 major Mathematical Physics (2012) JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2012					page 125 / 184	



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)

Module title				Abbreviation	
Relativi	istical	Quantumfield Theory			11-RQFT-092-m01
Module	e coord	inator		Module offered by	
Managi and Ast	ng Dire trophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Conten	ts				
Symme theory. normali	tries. L Feynm isation	agrange formalism for fie an rules. Quantum electr	elds. Field quantisatio odynamic processes	on. Gauge principle a in Born approximati	and interaction. Perturbation on. Radiative corrections and re-
Intende	ed lear	ning outcomes			
The stu They kn process standin	dents l now ho ses in t ng of ra	have mastered the princi w to use perturbation the he framework of quantur diative corrections and re	ples and underlying r ory and how to apply n electrodynamics in enormalisation.	mathematics of relati / Feynman rules. The leading order. Mored	ivistic quantum field theories. y are able to calculate basics over, they have a basic under-
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Gei	rman)	
R + V (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, information on whether
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.					
Allocation of places					
Additional information					
Workload					
Teaching cycle					



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

Module appears in

Module title Abbrev						
Quantum Field Theory II					11-QFT2-092-m01	
Module	e coord	inator		Module offered by		
Managi and Ast	ing Dire	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	ind Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	numerical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectur at the beginning of the sidered a declaration dents have obtained the course of the set sessment into effect ted to assessment i sessment at a later admission to assess	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Conten	ts		·			
Quantu theorie	m field s. Spor	l theory II. Generating f ntaneous symmetry bre	unctionals. Path integration integration in the second sec	al. Renormalisation. leory (optional).	Renormalisation gro	up. Gauge
Intende	ed lear	ning outcomes				
The stu red the probler	dents l princip ns of q	nave advanced knowle bles, especially of reno uantum field theory by	dge of the methods and rmalisation and gauge using the acquired cal	d concepts of quantu theories. They are al culation methods.	um field theory. They ole to formulate and	have maste- solve simple
Course	S (type, r	umber of weekly contact hour	s, language — if other than Gei	man)		
R + V (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	d of ass creditab	essment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if nc	ot every semester, informati	ion on whether
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.						amination in utes) or c) esentation sessment demic and
Allocat	ion of p	olaces				
Additional information						
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wi	th 1 majo	Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • ex. (120 ECTS) Mathematische P	am. reg. da- 'hysik - 2012	page 129 / 184

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) 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	
Particle Physics (Standard Model)					11-TPS-092-m01	
Module	coord	inator		Module offered by		
Managi the Inst	ng Dire itute o	ectors of the Institute of A f Theoretical Physics and	pplied Physics and Astrophysics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading Only after succ. compl. of module(s)						
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semestergraduateCertain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective de 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 the course of the semester, the lecturer will put their registration for sessment into effect. Students who meet all prerequisites will be at ted to assessment at a later date, students will have to obtain the qualification			alify for admission to as- nts about the respective details ion for the course will be con- ission to assessment. If stu- r admission to assessment over will put their registration for as- t all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for			
Conten	ts					
Introdu standar	ction to rd mod	o the theory of electrowea el and determination of r	ak interaction and sp nodel parameters.	ontaneous symmetry	y breaking. Experiments on the	
Intende	ed learı	ning outcomes	·			
The stu perimer theoret	dents l nts tha ical res	know the theoretical fund t have established and co sults in the framework of	amental laws of the sonfirmed the standar the standard model a	standard model of Pa d model. They are ab and know its validity	article Physics and the key ex- ble to interpret experimental or and limits.	
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
R + V (n	o infor	mation on SWS (weekly o	ontact hours) and co	urse language availa	able)	
Method module is	l of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
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.						
Allocati	ion of p	olaces				
Additional information						
Worklo	Workload					
leaching cycle						
Referre	Peferred to in LPO L (avamination regulations for teaching degree programmed)					

Module	e title				Abbreviation	
Theoretical Elementary Particle Physics					11-TEP-092-m01	
Module	e coord	inator		Module offered by		
Managi and Ast	ing Dire trophys	ector of the Institute of Th sics	neoretical Physics	Faculty of Physics a	ind Astronomy	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for				
Conten	ts					
Fundan Gauge t tension Intende The stu structur	nental theorie is of th ed lear dents a re of th	forces and particles. Grou s. Spontaneous symmetric e standard model. ning outcomes are familiar with the math e standard model based	ups and symmetries. ry breaking. Electrowe nematical methods of on symmetry princip	Quark model. Princi eak standard model. f Elementary Particle les and experimenta	ples of quantum field theory. Quantum chrome dynamics. Ex- Physics. They understand the I observations. They know calcu-	
re, they	netnod v know	the tests and limits of the	e standard model and	d the basics of Element	ded theories.	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	rman)		
R + V (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methoo module is	d of ass creditab	sessment (type, scope, langua ıle for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
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.						
Allocation of places						
Additional information						
Workload						
Teaching cycle						



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

Module appears in

Module	title				Abbreviation	
Supersymmetry I and II					11-SUS-092-m01	
Module coordinator				Module offered by		
Managi and Ast	ing Dire trophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for				
Conten	ts					
Supers persym Supers ticles. F	ymmet metry: ymmet Phenon	ry I: Grassmann variable. Algebra and multiplets. S ry II: Minimal supersymm nenology of LEP, Tevatror	Coleman-Mandula th Superfield formalism netric standard model n and LHC, supersym	neorem and Haag-Lo . Breaking of supersy l. Higgs sector. The s metric neutrino mass	puszanski-Sohnius theorem. Su- ymmetry. pectrum of supersymmetric par- s models. Violation of R-parity.	
Intende	ed lear	ning outcomes				
The stu tric mo importa	dents l dels. Tl ance fo	have knowledge of the m ney understand the theor r phenomenology of elen	athematical and phys y's formalism and rec nentary particles.	sical principles of su cognise its connectio	persymmetry and supersymme- ons to other models as well as its	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	rman)		
V + R (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
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.						
Allocation of places						
Additional information						
Workload						
Teachi	Teaching cycle					



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

Module appears in

Module title					Abbreviation		
Theoretical Astrophysics					11-AST-092-m01		
Module	e coord	inator		Module offered by			
Manag and As	ing Dire trophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
Theore	tical As	trophysics, models for th	e description of com	plex observation res	ults, numeric simulations.		
Intende	ed lear	ning outcomes					
The stu observ	idents ations	have basic knowledge of and to test the models wi	the methods of Theo th the help of simula	retical Astrophysics. tions.	They are able to design complex		
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	rman)			
R + V (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)		
Metho module is	d of ass	eessment (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether		
written	exami	nation (approx. 120 minu	tes)				
Allocat	ion of _l	olaces					
Additio	onal inf	ormation					
 Worklo							
WORKIO	au						
Teachi	ng cycl	e					
		•					
Referre	ed to in	LPOI (examination regulations	s for teaching-degree progra	mmes)			
			· · · · · · · · ·				
Module	e appea	nrs in					
Bachel	or' deg	ree (1 major) Physics (20:	10)				
Bachel	or' deg	ree (1 major) Physics (20:	12)				
Bachelor' degree (1 major) Mathematical Physics (2009)							
Bachel	Bachelor' degree (1 major) Mathematical Physics (2012)						
Master	s degr	ee (1 major) Physics (201)	0) A				
Master	's aegr	ee (1 major) Physics (201)	1) Debugies (2010)				
Master	Master's degree (1 major) Mathematical Physics (2012)						
Master	's degr	ee (1 major) FOKUS FIIYSI	cs (2010)				
Master	's degr	ee (1 major) FOKUS Physi	cs (2006)				

Module title					Abbreviation	
Moderr	n Astro	physics			11-MAS-111-m01	
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire trophys	ector of the Institute of sics	Theoretical Physics	cs Faculty of Physics and Astronomy		
ECTS Method of grading Only after succ. compl. of module(s)						
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate Certain prerequisites must be met to qualify for sessment. The lecturer will inform students abo at the beginning of the course. Registration for sidered a declaration of will to seek admission dents have obtained the qualification for admiss the course of the semester, the lecturer will put sessment into effect. Students who meet all pre- ted to assessment in the current or in the subse- sessment at a later date, students will have to o admission to accossment anow.		alify for admission to nts about the respec- ion for the course wi hission to assessmen r admission to asses will put their registra t all prerequisites wi e subsequent semes ave to obtain the qu	o as- ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as- alification for			
Conten	ts					
Introdu	ction to	o a field of modern Astr	ophysics, e.g. extra-ga	lactic jets.		
Intende	ed learı	ning outcomes				
The stu lues an observa	dents l d are to ational	know the current state (o plan and conduct obs project and e.g. to app	of research on the mod ervations in this area. ly for observation time	ern topic of Astroph This includes the ab at large telescopes.	ysics. They know the ility to conceptualise	physical va- e a specific
Course	S (type, n	umber of weekly contact hours	s, language — if other than Ge	rman)		
V + R (n	o infor	mation on SWS (weekly	y contact hours) and co	ourse language avail	able)	
Methoo module is	l of ass creditab	s essment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
a) writte groups project (approx Assess and wil examin Langua	en exar (appro report 3. 30 m ment o l be an ation re ge of a	mination (approx. 90 m x. 30 minutes per cand (approx. 8 to 10 pages, inutes) ffered: When and how nounced in due form u egulations) 2009. ssessment: German, En	inutes) or b) oral exam idate, for modules with time to complete: 1 to often assessment will l nder observance of Sec nglish	ination of one candi n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o ction 32 Subsection	date each or oral exa edits approx. 20 mir entation/seminar pre on the method of ase 3 ASPO (general aca	amination in nutes) or c) esentation sessment demic and
Allocat	ion of p	olaces				
Additional information						
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	e appea	nrs in				
Master's wi	th 1 majoı	Mathematical Physics (2012)	JMU Würzburg ● ta record Master	generated 26-Aug-2024 • ex (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 138 / 184



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) FOKUS Physics (2006)

Module title					Abbreviation		
Cosmol	Cosmology				11-AKM-092-m01		
Module	coord	inator		Module offered by			
Managing Director of the Institute of Th and Astrophysics			neoretical Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)			
6	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for					
Conten	ts						
Expand matter, and gal	ing spa primor axy clu	ace-time, Friedmannian o rdial nucleosynthesis, co sters, intergalactic medi	cosmology, basics of smic microwave back um, cosmological pa	general relativity, the ground, structure fo rameters	e early universe, infla rmation, supercluste	ation, dark er, galaxies	
Intende	ed learr	ning outcomes					
The stu le to rel scientif	dents ł ate the ic ques	nave basic knowledge of em to observations. They stions.	cosmology. They kno have gained insights	w the theoretical me into current researc	thods of cosmology h topics and are able	and are ab- e to work on	
Courses	5 (type, n	umber of weekly contact hours,	language — if other than Ger	man)			
R + V (n	o infor	mation on SWS (weekly	contact hours) and co	ourse language availa	able)		
Method module is	l of ass creditab	s essment (type, scope, langua le for bonus)	age — if other than German, o	examination offered — if no	t every semester, informati	on on whether	
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.						amination in nutes) or c) esentation sessment demic and	
Allocati	ion of p	olaces					
Additional information							
Workload							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Master's wi	th 1 major	Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • exa (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 140 / 184	

Module title					Abbreviation	
Introdu	ction t	o Plasmaphysics			11-EPP-092-m01	
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire rophys	ector of the Institute of ⁻ ics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	Only after succ. compl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semestergraduateCertain prerequisites must be met sessment. The lecturer will inform at the beginning of the course. Reg sidered a declaration of will to see dents have obtained the qualificat the course of the semester, the lec sessment into effect. Students wh ted to assessment in the current o sessment at a later date, students		s must be met to qua rer will inform studer the course. Registration of will to seek adm the qualification for mester, the lecturer w t. Students who meet the current or in the date, students will has sment anew.	alify for admission to nts about the respec- ion for the course wi ission to assessmer r admission to asses will put their registra t all prerequisites wi e subsequent semes ave to obtain the qua	as- tive details ll be con- it. If stu- sment over tion for as- ll be admit- ster. For as- alification for		
Content	ts		1			
Plasma Transpo thin the celerati	Astrop ort equa solar on and	hysics: Dynamics of ch ations for energetic par wind, Particle accelerat transport in galaxies a	arged particles in elect ticles, Properties of ma ion via shock waves ar nd other astrophysical	tric and magnetic fiel agnetic turbulence, P nd via interaction wit objects, Cosmic rad	lds, Magnetohydrod ropagation of solar h plasma turbulence iation.	ynamics, particles wi- e, Particle ac-
Intende	ed learr	ning outcomes				
The stu ma. The	dents l ey are a	know the principles of F ble to solve basic prob	Plasma Physics, especi lems of Plasma Physic	ally the description of a state of the second	of transport phenom nowledge to Astroph	ena in plas- iysics.
Courses	S (type, n	umber of weekly contact hours	, language — if other than Ger	man)		
V + R (n	o infor	mation on SWS (weekly	v contact hours) and co	ourse language availa	able)	
Method module is	l of ass creditab	essment (type, scope, lang le for bonus)	uage — if other than German, e	examination offered — if no	t every semester, informati	on on whether
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.						
Allocati	ion of p	laces	-			
Additional information						
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wit	th 1 major	Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • exa (120 ECTS) Mathematische Ph	am. reg. da- hysik - 2012	page 142 / 184



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

Module title					Abbreviation	
Plasma	Plasma-Astrophysics 11-APL-092-m01					
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire rophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for				
Conten	ts					
Plasma getic pa accelera galaxie	Astrop articles ation v s and c	hysics: Dynamics of cha . Properties of magnetic t ia shock waves and via in other cosmic objects.	rged particles in elec curbulence. Propagat nteraction with plasm	tric and magnetic fie ion of solar particles na turbulence. Particl	lds. Transport equations for ener- within the solar wind. Particle le acceleration and transport in	
Intende	ed leari	ning outcomes				
The stu motion compar	dents l and ac re and c	nave basic knowledge of celeration of charged pa evaluate theory and expe	Plasma Astrophysics rticles in space, they riments.	. They have mastere know corresponding	d the theoretical description of g measuring methods and can	
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)		
R + V (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Method module is	l of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether	
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.						
Allocation of places						
Additional information						
Workload						
Teaching cycle						


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) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Module	title				Abbreviation			
Comput	Computational Astrophysics 11-NMA-111-m01							
Module	coord	inator		Module offered by				
Managi and Ast	ng Dire trophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy			
ECTS	Metho	od of grading	Only after succ. compl. of module(s)					
6 numerical grade								
Duratio	n	Module level	Other prerequisites					
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for						
Conten	tc							
Intended learning outcomes 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.								
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Gei	rman)				
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)			
Methoo module is	l of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, information on whether			
a) written examination (approx. 120 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 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.								
Allocat	ion of p	olaces						
Additional information								
Worklo	ad							
Teachir	Teaching cycle							

Module appears in

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2012)

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

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

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

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

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

Module title					Abbreviation	
Concep	ts of T	heoretical Astroparticle p	11-ATT-111-m01			
Module	Module coordinator Modu					
Managi and Ast	ng Dire trophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading Only after succ. compl. of module(s)						
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate Ce se: at sic de the se: teo se		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anow.				
Conten	ts					
Concep mic acc	ts of The elerate	neoretical Astro-Particle F prs, dark energy, inflation	Physics, e.g. Dark ma	tter, cosmic radiatio	n, neutrinos, baryogenesis, cos-	
Intende	ed learı	ning outcomes				
The stu be pher proach	dents l nomen es for p	nave basic knowledge of a of Astroparticle Physics problems.	the concepts of Theo on the basis of meth	pretical Astroparticle nods of Theoretical P	Physics. They are able to descri- hysics and to find solution ap-	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)		
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Methoo module is	l of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether	
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						
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	immes)		
Module	e appea	urs in				

Master's with 1 major Mathematical Physics (2012)



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) FOKUS Physics (2006)

Module title					Abbreviation		
Quantu	Quantum Loop Gravity 11-QSG-102-m01						
Module	coord	inator	Module offered by				
Managi and Ast	ng Dire trophys	ector of the Institute of T sics	heoretical Physics	Faculty of Physics a	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
4	nume	rical grade		· · · · · ·			
Duratio	n	Module level	Other prerequisites				
1 semester graduate		Certain prerequisite sessment. The lectur at the beginning of the sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for				
Conten	ts		•				
Aside fr chanica bles are on disc Therefo Intende	Aside from string theory, quantum loop gravity (QLG) is one of the most important approaches to a quantum me- chanical description of gravity. General relativity is formulated in Hamiltonian formalism and the elemental varia- bles are identified with the corresponding Poisson brackets. These variables are quantised in the typical manner on discretised graphs, so-called spin networks. In doing so, e.g. a quantisation of elemental volumes appears. Therefore, QLG belongs to the speculative theories which paint a picture of the constitution of space and time.						
The stu ted top	dents l ic and	know the principles of q have proved their know	uantum loop gravity. T ledge in a seminar pre	They have acquired a sentation.	dvanced knowledge	of a selec-	
Course	S (type, n	umber of weekly contact hours	, language — if other than Ge	rman)			
V + S (n	infor	mation on SWS (weekly	contact hours) and co	ourse language availa	able)		
Methoo module is	d of ass creditab	e essment (type, scope, langu le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informatio	on on whether	
 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) Language of assessment: German, English 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 							
Allocati	ion of r		_				
Additional information							
Workload							
Teaching cycle							
Master's wi	th 1 majoi	Mathematical Physics (2012)	JMU Würzburg ● ta record Master	generated 26-Aug-2024 • exa (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 150 / 184	

Module appears in

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) FOKUS Physics (2006)



Complex Systems, Quantum control and Biophysics

(ECTS credits)

Module title					Abbreviation
Physics	Physics of Complex Systems				11-PKS-092-m01
Module	Module coordinator			Module offered by	
Managi and Ast	ng Dire rophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy
ECTS Method of grading Only after succ. compl. of module(s)					
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment apow			
Conten	ts				
2. Intro 3. Entro 4. Phas 5. Unive 6. Spin 7. Theo	duction py pro e trans ersality glasse ry of ne	into the physics out of e duction and fluctuations itions away from equilibr t st eural networks	equilibriumt t fiumt		
Intende	ed learn	ning outcomes			
The stu method such sy	dents I ls of St stems.	nave specific and advanc atistical Physics, Compu They are able to work or	ed knowledge in the tational Physics and current research pro	field of physics of co non-linear dynamics oblems in this area.	omplex systems. They know the , which are used to describe
Courses	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
R + V (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Method module is	l of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
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					
Allocati	ion of p	olaces			
Additional information					
Worklo	ad				

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) 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)

Module title					Abbreviation	
Quantum Information and Quantum Computing					11-QIC-092-m01	
Module	e coord	inator		Module offered by		
Manag and As	ing Dire trophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester graduate Cer ses at t side der the ses ted ses		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for				
Conten	ts					
The firs ses the entang tron sp states.	st part i main o led sta in state	ntroduces the theoretical quantum algorithms. The tes. One of the main topi es. The third part covers t	l concepts of quantur second part discuss cs is the production, he description and e	n information and qu es experimental pos controlling and man xplanation of decohe	uantum computers. It discus- sibilities for the realisation of ipulation of coherent two-elec- erence of quantum mechanical	
Intende	ed lear	ning outcomes				
The stu They ar	idents l re able	have an advanced unders to solve simple problems	standing of quantum s of quantum informa	theory and basic kno tion theory.	owledge of quantum calculation.	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	rman)		
R + V (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Method module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether	
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						
Worklo	Workload					
 Teachi		0				
reachill	ing cycl	e				

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) 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)





Oberseminar

(ECTS credits)

Module title					Abbreviation
Advanc	ed Sen	ninar Mathematical Phys	ics		11-OSM-122-m01
Module	e coord	inator		Module offered by	
Managi the Inst	ing Dire titute o	ectors of the Institute of A f Theoretical Physics and	Applied Physics and Astrophysics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
4	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Semina	ir on cu	irrent issues of Mathema	tical Physics.		
Intende	ed lear	ning outcomes			
The stu tract kn nal aud	dents l lowled lience.	have advanced knowledg ge from professional pub	e of a current specia lications and to sum	list field of Mathema marise this knowled	tical Physics. They are able to ex- ge and present it to a professio-
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Gei	rman)	
S (no ir	format	tion on SWS (weekly cont	act hours) and cours	e language available	e)
Method	d of ass	sessment (type, scope, langua	ge — if other than German,	examination offered — if no	t every semester, information on whether
module is	creditab	le for bonus)			
talk and Langua	d discu ge of a	ssion (approx. 30 to 45 n ssessment: German, Eng	ninutes) lish		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	e appea	ars in			
Master's degree (1 major) Mathematical Physics (2012)					



Compulsory Electives Workshops and Current Topics

(ECTS credits)

Module title					Abbreviation	
Study (Group N	Aodern Differential Geon	netry		11-AG-MMDG-122-m01	
Module	Module coordinator			Module offered by		
chairpe	erson o	f examination committee		Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester graduate Certa sess at the sider dent the c sess ted t sess		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for				
Conten	ts					
Introdu researc	ction to h area.	o current questions of Mo Summary of the required	odern Differential Geo d fundamental topics	ometry as a preparati in a seminar presen	ion for a Master's thesis in this Itation.	
Intende	ed learı	ning outcomes				
The stu researc	dents l h topic	nave advanced knowledg s. They are able to summ	e of modern different narise their knowledg	tial geometry and ha e in an oral presenta	ve gained insights into current ation.	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
S (no ir	nformat	ion on SWS (weekly cont	act hours) and cours	e language available	a)	
Methoo module is	d of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk wit Assess and wil examin Langua	h discu ment o l be an ation r ge of a	ission (approx. 30 to 45 r ffered: When and how of nounced in due form unc egulations) 2009. ssessment: German, Eng	ninutes) ten assessment will t ler observance of Sec lish	oe offered depends o tion 32 Subsection	on the method of assessment 3 ASPO (general academic and	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	Teaching cycle					
Reterred to in LPO I (examination regulations for teaching-degree programmes)						
Module	annes	urs in				
Master	s degr	ee (1 major) Mathematica	Physics (2012)			
אמזנר 5 מכקרכי (ב major) אמנורכוומנוכמר mysics (2012)						

Study Group Symplectic and Poisson Geometry 11-AG-SPG-122-m01 Module coordinator Module offered by chairperson of examination committee Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade Duration Module level 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					
Module coordinator Module offered by chairperson of examination committee Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade Duration Module level 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					
chairperson of examination committee Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade Duration Module level 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					
ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade Duration Module level 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					
10 numerical grade Duration Module level 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					
DurationModule levelOther prerequisites1 semestergraduateCertain 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					
1 semestergraduateCertain 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 as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.					
Contents					
Introduction to current questions of symplectic geometry and Poisson geometry as a preparation for a Master's thesis in this research area. Summary of the required fundamental topics in a seminar presentation.					
Intended learning outcomes					
The students have advanced knowledge of Symplectic and Poisson geometry and have gained insights into cur- rent research topics. They are able to summarise their knowledge in an oral presentation.					
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 is creditable for bonus)					
talk with discussion (approx. 30 to 45 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					
Master's degree (1 major) Mathematical Physics (2012)					

Module	Module title Abbreviation					
Study G	Group C	Operator Algebras and Re	epresentation Theory		11-AG-OAD-122-m01	
Module	coord	inator		Module offered by		
chairpe	rson o	f examination committee	_	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate Cen ses at t sid den the ses ted ses		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for				
Conten	ts					
Introdu thesis i	ction to n this r	o current questions of op research area. Summary (erator algebra and re of the required funda	presentation theory mental topics in a se	as a preparation for a Master's eminar presentation.	
Intende	ed learı	ning outcomes				
The stu into cur	dents l rrent re	nave advanced knowledg search topics. They are a	e of operator algebra ble to summarise the	and representation ir knowledge in an c	theory and have gained insights oral presentation.	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
S (no in	Iformat	ion on SWS (weekly cont	act hours) and cours	e language available	a)	
Method module is	l of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk wit Assessi and wil examin Langua	h discu ment o l be an ation r ge of a	Ission (approx. 30 to 45 r ffered: When and how of nounced in due form unc egulations) 2009. ssessment: German, Eng	ninutes) ten assessment will t ler observance of Sec lish	be offered depends of the section 32 Subsection 33	on the method of assessment 3 ASPO (general academic and	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachír	ig cycl	e				
 Doforra						
Keterred to In LPU I (examination regulations for teaching-degree programmes)						
Module	annea	urs in				
Master'	s degr	ee (1 major) Mathematica	Il Physics (2012)			

Module title					Abbreviation	
Study Group Hopf Algebras					11-AG-HAL-122-m01	
Module coordinator				Module offered by		
chairperson of examination committee				Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for				
Conten	ts					
Introdu Summa	ction to ary of th	o current questions of Ho ne required fundamental	pf algebra as a prepa topics in a seminar p	ration for a Master's resentation.	thesis in this research area.	
Intende	ed learı	ning outcomes				
The stu They ar	dents l e able	nave advanced knowledg to summarise their know	e of Hopf algebra and ledge in an oral prese	d have gained insigh entation.	ts into current research topics.	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
S (no ir	nformat	ion on SWS (weekly cont	act hours) and cours	e language available	a)	
Methoo module is	d of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk wit Assess and wil examin Langua	h discu ment o l be an ation r ge of a	Ission (approx. 30 to 45 r ffered: When and how of nounced in due form unc egulations) 2009. ssessment: German, Eng	ninutes) ten assessment will b ler observance of Sec lish	e offered depends o tion 32 Subsection	on the method of assessment 3 ASPO (general academic and	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Reterred to in LPO I (examination regulations for teaching-degree programmes)						
Modula						
Master	s degr	ee (1 major) Mathematica	Physics (2012)			

Module title		Abbreviation				
Study Group Co	onformal Field Theory			11-AG-KFT-122-m01		
Module coordi	nator		Module offered by			
chairperson of	examination committee		Faculty of Physics a	nd Astronomy		
ECTS Metho	d of grading	Only after succ. com	pl. of module(s)			
10 numeri	ical grade					
Duration	Module level	Other prerequisites				
1 semester graduate Cert sess at th side den the sess ted ses		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment an admitester and the semester.				
Contents						
Introduction to area. Summary	current questions of con of the required fundam	nformal field theory a ental topics in a semi	s a preparation for a inar presentation.	Master's thesis in this research		
Intended learn	ing outcomes					
The students h topics. They are	ave advanced knowledg e able to summarise the	e of conformal field t ir knowledge in an or	heory and have gain al presentation.	ed insights into current research		
Courses (type, nu	umber of weekly contact hours, l	anguage — if other than Ger	man)			
S (no informati	on on SWS (weekly cont	act hours) and course	e language available	2)		
Method of asse module is creditable	essment (type, scope, langua e for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether		
talk with discus Assessment off and will be ann examination re Language of as	ssion (approx. 30 to 45 r fered: When and how of nounced in due form unc gulations) 2009. ssessment: German, Eng	ninutes) ten assessment will b ler observance of Sec lish	e offered depends o tion 32 Subsection :	on the method of assessment 3 ASPO (general academic and		
Allocation of p	laces					
Additional info	rmation					
Workload						
Referred to in IPO I (examination regulations for teaching degree programmec)						
Module appear	rs in					
Master's degre	e (1 major) Mathematica	l Physics (2012)				

Module title					Abbreviation	
Study Group Statistical Mechanics					11-AG-STM-122-m01	
Module	coord	inator		Module offered by		
chairpe	rson o	f examination committee		Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate Certain prerequisites must be met to qualify for adm sessment. The lecturer will inform students about th at the beginning of the course. Registration for the c sidered a declaration of will to seek admission to as dents have obtained the qualification for admission the course of the semester, the lecturer will put their sessment into effect. Students who meet all prerequited to assessment in the current or in the subsequent sessment at a later date, students will have to obtain admission to assessment anow.		alify for admission to as- nts about the respective details ion for the course will be con- nission to assessment. If stu- r admission to assessment over will put their registration for as- t all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for				
Conten	ts					
Introdu area. Si	ction to ummar	o current questions of sta y of the required fundam	tistical mechanics as ental topics in a sem	a preparation for a inar presentation.	Master's thesis in this research	
Intende	ed learı	ning outcomes				
The stu topics.	dents l They a	nave advanced knowledg re able to summarise the	e of statistical mecha ir knowledge in an or	anics and have gaine al presentation.	ed insights into current research	
Courses	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
S (no in	Iformat	ion on SWS (weekly cont	act hours) and cours	e language available	2)	
Method module is	l of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk wit Assessi and wil examin Langua	h discu ment o l be an ation r ge of a	Ission (approx. 30 to 45 r ffered: When and how of nounced in due form unc egulations) 2009. ssessment: German, Eng	ninutes) ten assessment will b ler observance of Sec lish	e offered depends o tion 32 Subsection 3	on the method of assessment 3 ASPO (general academic and	
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	Workload					
	יה נענו	•				
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
Module	appea	irs in				
Master'	s degr	ee (1 major) Mathematica	ll Physics (2012)			

Module title					Abbreviation	
Study Group Quantum Field Theory					11-AG-QFT-122-m01	
Module coordinator				Module offered by		
chairpe	erson o	f examination committee		Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate Certain prerequisites must be met to qualify for admissi sessment. The lecturer will inform students about the re at the beginning of the course. Registration for the course sidered a declaration of will to seek admission to assess dents have obtained the qualification for admission to a the course of the semester, the lecturer will put their reg sessment into effect. Students who meet all prerequisite ted to assessment in the current or in the subsequent se sessment at a later date, students will have to obtain th admission to assessment anew.		alify for admission to as- nts about the respective details ion for the course will be con- nission to assessment. If stu- r admission to assessment over will put their registration for as- t all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for				
Conten	ts					
Introdu Summa	ction to ary of th	o current questions of qu ne required fundamental	antum field theory as topics in a seminar p	a preparation for a resentation.	Master's thesis in this research.	
Intende	ed lear	ning outcomes				
The stu topics.	dents l They a	have advanced knowledg re able to summarise the	e of quantum field th ir knowledge in an or	eory and have gaine al presentation.	ed insights into current research	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
S (no ir	format	ion on SWS (weekly cont	act hours) and cours	e language available	2)	
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk wit Assess and wil examin Langua	h discu ment o l be an ation r ge of a	ussion (approx. 30 to 45 r ffered: When and how of nounced in due form unc egulations) 2009. ssessment: German, Eng	ninutes) ten assessment will b ler observance of Sec lish	e offered depends o tion 32 Subsection 3	on the method of assessment 3 ASPO (general academic and	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	Teaching cycle					
	al 4 a 1 a		6	`		
Keterre	Reterred to in LPO I (examination regulations for teaching-degree programmes)					
Module	annes	urs in				
Master	's degr	ee (1 maior) Mathematica	l Physics (2012)			
	masier s uegree (1 majur) maniemanical frigsics (2012)					

Module title					Abbreviation
Study Group Riemannian Geometry					11-AG-RGE-122-m01
Module coordinator				Module offered by	
chairpe	erson o	f examination committee		Faculty of Physics a	and Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semester graduate Certain prerequisites must be met to sessment. The lecturer will inform stu at the beginning of the course. Regist sidered a declaration of will to seek a dents have obtained the qualification the course of the semester, the lectur sessment into effect. Students who m ted to assessment in the current or in sessment at a later date, students will admission to according to according to according to the course of the semester.		s must be met to qua rer will inform stude he course. Registrat n of will to seek adm the qualification fo mester, the lecturer t. Students who mee n the current or in th date, students will h sment anew.	alify for admission to as- nts about the respective details ion for the course will be con- nission to assessment. If stu- r admission to assessment over will put their registration for as- at all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for		
Conten	ts				
Introdu area. S	ction to ummar	o current questions of Rie y of the required fundam	emannian geometry a ental topics in a sem	s a preparation for a inar presentation.	Master's thesis in this research
Intende	ed leari	ning outcomes			
The stu topics.	dents l They a	have advanced knowledg re able to summarise the	e of Riemannian geo ir knowledge in an or	metry and have gain al presentation.	ed insights into current research
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
S (no in	format	ion on SWS (weekly cont	act hours) and cours	e language available	<u>a)</u>
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
talk and Assess and wil examin Langua	d discu ment o l be an ation r ge of a	ssion (approx. 30 to 45 n ffered: When and how of nounced in due form unc egulations) 2009. ssessment: German, Eng	ninutes) ten assessment will b ler observance of Sec lish	be offered depends of the section 32 Subsection 3	on the method of assessment 3 ASPO (general academic and
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Workload					
Teachir	Teaching cycle				
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				
 Modula		urc in			
Master	s degr	us III ee (1 maior) Mathematics	Physics (2012)		
master's degree (1 major) Mathematical Physics (2012)					

Module title					Abbreviation	
Study Group Mathematical Physics					11-AG-MPH-122-m01	
Module	coord	inator		Module offered by		
chairper Physik (rson of Mathe	examination committee matical Physics)	Mathematische	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
10	nume	rical grade				
Duration	n	Module level	Other prerequisites			
1 semester graduate Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective of at the beginning of the course. Registration for the course will be sidered a declaration of will to seek admission to assessment. If set dents have obtained the qualification for admission to assessme the course of the semester, the lecturer will put their registration sessment into effect. Students who meet all prerequisites will be ted to assessment in the current or in the subsequent semester. If sessment at a later date, students will have to obtain the qualifica-			alify for admission to as- nts about the respective details ion for the course will be con- nission to assessment. If stu- r admission to assessment over will put their registration for as- t all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for			
Content	s					
Introduc area. Su	ction to Immar	o current questions of Ma y of the required fundam	thematical Physics a ental topics in a sem	is a preparation for a inar presentation.	Master's thesis in this research	
Intende	d learr	ning outcomes	·	•		
The stuc topics. T	dents l They a	nave advanced knowledg re able to summarise the	e of Mathematical Ph ir knowledge in an or	nysics and have gain ral presentation.	ed insights into current research	
Courses	(type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)		
S (no inf	format	ion on SWS (weekly cont	act hours) and cours	e language available	a)	
Method module is a	of ass creditab	e essment (type, scope, langua) le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk with Assessm and will examina Languag	n discu nent o be an ation ro ge of a	ission (approx. 30 to 45 r ffered: When and how off nounced in due form und egulations) 2009. ssessment: German, Eng	ninutes) ten assessment will t ler observance of Sec lish	pe offered depends of the section 32 Subsection 32 Subsect	on the method of assessment 3 ASPO (general academic and	
Allocatio	on of p	laces				
Additior	nal info	ormation				
 We 1-1-						
workloa	a					
Teaching						
Referred	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
		_				
Module	appea	rs in				
Master's	s degre	ee (1 major) Mathematica	l Physics (2012)			

Module title Abbreviation						
Study (Study Group Algebra 10-M=GALG-102-m01					
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mather	matics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Registration for the ning of the course o specified registratio ly be open for stude areas. Where applic	seminar must be ma r as announced by th n deadlines. Some s nts with previous kn able, details will be	de via SB@home at ne lecturer in accord eminars or worksho owledge and/or skil specified in the class	the begin- ance with the ps might on- ls in certain s schedule.
Conten	ts					
Selecte puter a Recomi Basic k "Applie	ed mod lgebra, mende nowlec ed Algel	ern topics in algebra (e algebras, division ring d previous knowledge: lge of algebra is assum bra".	. g. ring theory, commu s, quadratic forms). ed, such as can be acc	itative algebra, differ quired in the module	ential algebra, local s "Introduction to Alg	fields, com- gebra" and
Intende	ed lear	ning outcomes				
The stu ques in	dent ga this fi	ains insight into conter eld and can apply them	nporary research proble to complex problems.	ems in algebra. He/S	She masters advance	ed techni-
Course	S (type, r	number of weekly contact hour	s, language — if other than Ger	rman)		
V + S (r	no infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
Methoo module is	d of ass creditab	Sessment (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether
At the t minar p sentation of one of Assess semest Langua	beginni oresent on of a candid ment o cer, cou ge of a	ng of the course, the le ation (approx. 60 to 12 pprox. 60 to 120 minut ate each (approx. 20 m ffered: Assessment off rse offered on demand ssessment: German, E	cturer will choose one o minutes), b) written e es, c) written examinat inutes), e) oral examin ered in the semester in or every four semester nglish	or two of the followir elaboration of conter ion (approx. 90 to 12 ation in groups (grou which the course is 's.	ng methods of asses nts equivalent to a se o minutes), d) oral e nps of 2, approx. 30 n offered and in the su	sment: a) se- eminar pre- examination minutes) ubsequent
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
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) Mathematical Physics (2012)						
Master's wi	ith 1 majo	r Mathematical Physics (2012)	JMU Würzburg • ta record Master	generated 26-Aug-2024 • exa (120 ECTS) Mathematische P	am. reg. da- hysik - 2012	page 169 / 184

Module title					Abbreviation	
Study Group Discrete Mathematics					10-M=GDIM-102-m01	
Module	coord	inator		Module offered by		
Dean of	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate Regist ning o specif ly be c areas		Registration for the s ning of the course o specified registratio ly be open for stude areas. Where applic	Registration for the seminar 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. Some seminars or workshops might on- y 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					
Selecte	d mod	ern topics in discrete mat	thematics.			
Intende	ed lear	ning outcomes				
The stu ced tec	dent ga hnique	ains insight into contemp is in this field and can ap	oorary research proble ply them to complex	ems in discrete math problems.	nematics. He/She masters advan-	
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + S (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Method module is	l of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
At the b minar p sentation of one of Langua	beginni present on of a candid ge of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 120 minutes ate each (approx. 20 min ssessment: German, Eng	urer will choose one minutes), b) written e , c) written examinati utes), e) oral examina lish	or two of the followir elaboration of conter ion (approx. 90 to 12 ation in groups (grou	ng methods of assessment: a) se- nts equivalent to a seminar pre- o minutes), d) oral examination ups of 2, approx. 30 minutes)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	Teaching cycle					
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	appea	irs in				
Master'	s degr	ee (1 major) Mathematics	5 (2012) 5 (2010)			
Master'	s degr	ee (1 major) Mathematica	al Physics (2012)			
L	אומטנר ש מכצובב (ב ווומוסו) אומנווכווומנוכמו דוואטובש (2012)					

Module title				Abbreviation		
Study Group Dynamical Systems and Control					10-M=GDSR-102-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate Registration for the seminar must be ning of the course or as announced b specified registration deadlines. Som ly be open for students with previous areas. Where applicable, details will		seminar must be ma r as announced by th n deadlines. Some s nts with previous kn able, details will be	de via SB@home at the begin- ne lecturer in accordance with the seminars or workshops might on- owledge and/or skills in certain specified in the class schedule.			
Conten	ts					
Selecte Recom Knowle	ed mod mende	ern topics in dynamical s d previous knowledge: the contents of the modu	ystems and control tl ıle "Mathematical Co	neory. ntrol Theory" or "Cor	ntrol Theory" is required.	
Intende	ed leari	ning outcomes				
The stu She ma	dent ga sters a	ains insight into contemp dvanced techniques in th	oorary research problenis field and can app	ems in dynamical sy ly them to complex p	stems and control theory. He/ problems.	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + S (r	no infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)	
Method module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
At the t minar p sentati of one Langua	beginni present on of a candida ge of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 120 minutes ate each (approx. 20 min ssessment: German, Eng	urer will choose one minutes), b) written e , c) written examinati utes), e) oral examina lish	or two of the followin elaboration of conter ion (approx. 90 to 12 ation in groups (grou	ng methods of assessment: a) se- nts equivalent to a seminar pre- to minutes), d) oral examination ups of 2, approx. 30 minutes)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master Master	Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010)					
Master	's degr	ee (1 major) Economathe	matics (2011)			
Master	's degr	ee (1 major) Mathematica	l Physics (2012)			

Module title				Abbreviation			
Study Group Complex Analysis					10-M=GFTH-102-m01		
Module	e coord	inator		Module offered by			
Dean o	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics		
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)			
10	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 semestergraduateRegistration for the seminar n ning of the course or as anno specified registration deadlin ly be open for students with p areas. Where applicable, det		seminar must be ma r as announced by th n deadlines. Some s nts with previous kn able, details will be	de via SB@home at the begin- ne lecturer in accordance with the eminars or workshops might on- owledge and/or skills in certain specified in the class schedule.				
Conten	ts						
Selecte geomet Recom Depend on with	ed mode tric com mendee ding on the lee	ern topics in complex and pplex analysis, value dist d previous knowledge: the current focus of the o cturer at the beginning of	alysis (e.g. in approx ribution theory). course, knowledge fro the course is recomr	imation theory, pote om different areas of nended.	ntial theory, complex dynamics, ^F analysis is required. Consultati-		
Intende	ed learr	ning outcomes					
The stu technic	dent ga Jues in	ains insight into contemp this field and can apply t	orary research proble hem to complex prob	ems in complex anal blems.	ysis. He/She masters advanced		
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)			
V + S (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)		
Methoo module is	d of ass creditab	e essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether		
At the t minar p sentation of one of Langua	beginni present on of a candida ge of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 120 minutes ate each (approx. 20 min ssessment: German, Eng	urer will choose one minutes), b) written e , c) written examinati utes), e) oral examina lish	or two of the followir elaboration of conter ion (approx. 90 to 12 ation in groups (grou	ng methods of assessment: a) se- its equivalent to a seminar pre- o minutes), d) oral examination ips of 2, approx. 30 minutes)		
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	Workload						
Teaching cycle							
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	e appea	irs in					
Master	's degre	ee (1 major) Mathematics	(2012) (2010)				
Master	's degre	ee (1 major) Mathematica	ll Physics (2012)				
L							

Module title				Abbreviation	
Study Group Geometry and Topology					10-M=GGMT-102-m01
Module	coord	inator		Module offered by	
Dean of	fStudi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semestergraduateRegistration for the semining of the course or as an specified registration deadly be open for students widdle areas. Where applicable.		seminar must be ma r as announced by th n deadlines. Some s nts with previous kn able, details will be	de via SB@home at the begin- ne lecturer in accordance with the eminars or workshops might on- owledge and/or skills in certain specified in the class schedule.		
Conten	ts				
Selecte	d mod	ern topics in geometry an	id topology.		
Intende	ed leari	ning outcomes			
The stu vanced	dent ga techni	ains insight into contemp ques in this field and car	orary research proble apply them to comp	ems in geometry and lex problems.	l topology. He/She masters ad-
Courses	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + S (n	io infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)
Methoo module is	l of ass creditab	e essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
At the b minar p sentation of one of Langua	beginni bresent on of a candida ge of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 120 minutes ate each (approx. 20 min ssessment: German, Eng	urer will choose one minutes), b) written e , c) written examinati utes), e) oral examina lish	or two of the followir elaboration of conter ion (approx. 90 to 12 ation in groups (grou	ng methods of assessment: a) se- nts equivalent to a seminar pre- o minutes), d) oral examination ups of 2, approx. 30 minutes)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ng cycl	e			
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				
Module	Module appears in				
Master'	s degr	ee (1 major) Mathematics	(2012)		
Master'	s degr	ee (1 major) Mathematica	ll Physics (2012)		
אומטנר ש ערבוכב (ב ווומוסו) אומנווכווומנוכמו דוואטובש (2012)					

Module title				Abbreviation	
Study Group Measure and Integral				10-M=GMUI-102-m01	
Module	e coord	inator		Module offered by	
Dean of	fStudie	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme:	ster	graduate	Registration for the s ning of the course o specified registratio ly be open for stude areas. Where applic	seminar must be ma r as announced by th n deadlines. Some s nts with previous kn able, details will be	de via SB@home at the begin- ne lecturer in accordance with the seminars or workshops might on- owledge and/or skills in certain specified in the class schedule.
Conten	ts				
Aspects function transfo	s of me ns and rmatioi	asure and integration the Lebesgue integrals, sele n rule), Lp spaces and ab	eory: sigma algebras cted applications, e. solute continuity, me	and Borel sets, volu g. product measures asures on topologic	me and measure, measurable s (with Fubini's theorem and the al spaces.
Intende	ed learı	ning outcomes			
The stu sters ac	dent ga dvance	ains insight into contemp d techniques in this field	oorary research proble and can apply them	ems in measure and to complex problem	integration theory. He/She ma- s.
Course	S (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)	
V + S (n	infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)
Methoo module is	d of ass creditab	eessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
At the b minar p sentatio of one o Langua	beginni present on of a candida ge of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 120 minutes ate each (approx. 20 min ssessment: German, Eng	urer will choose one minutes), b) written e , c) written examinati utes), e) oral examina lish	or two of the followin laboration of conter on (approx. 90 to 12 ation in groups (grou	ng methods of assessment: a) se- nts equivalent to a seminar pre- co minutes), d) oral examination ups of 2, approx. 30 minutes)
Allocat	ion of p	olaces			
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 degr	ee (1 major) Mathematics	5 (2012)		
Master'	's degr	ee (1 major) Mathematics	(2010)		
Master'	s degr	ee (1 major) Economathe ee (1 major) Mathematica	matics (2011)		
master's degree (1 major) Mathematical Physics (2012)					

Module title				Abbreviation			
Study (Group N	Iumerical Mathematics a	nd Applied Analysis		10-M=GNMA-102-m01		
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics		
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)			
10	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semester graduate Registration for the seminar must be made via SB@hom ning of the course or as announced by the lecturer in ac specified registration deadlines. Some seminars or work ly be open for students with previous knowledge and/or areas. Where applicable, details will be specified in the seminary of the semina			de via SB@home at the begin- ne lecturer in accordance with the eminars or workshops might on- owledge and/or skills in certain specified in the class schedule.				
Conten	ts						
Selecte	d topic	s in numerical mathemat	tics, applied analysis	or scientific comput	ting.		
Depend themat	ling on	the content, basic and a equired. In case of doubt,	dvanced knowledge , it is recommended t	from different areas to consult the lecture	of analysis and/or numerical ma- er.		
Intende	ed lear	ning outcomes					
The stu He/She	dent ga e maste	ains insight into a conten ers advanced techniques	nporary research prob in this field and can a	olems in numerical n apply them to compl	nathematics or applied analysis. ex problems.		
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	rman)			
V + S (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)		
Methoo module is	d of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether		
At the b minar p sentation of one of Langua	beginni present on of a candid ge of a	ng of the course, the lect ation (approx. 60 to 120 f pprox. 60 to 120 minutes ate each (approx. 20 min ssessment: German, Eng	urer will choose one minutes), b) written e , c) written examinati utes), e) oral examina lish	or two of the followin elaboration of conter ion (approx. 90 to 12 ation in groups (grou	ng methods of assessment: a) se- nts equivalent to a seminar pre- o minutes), d) oral examination nps of 2, approx. 30 minutes)		
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
Teachir	ıg cycl	e					
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module	e appea	irs in					
Master	's degr	ee (1 major) Mathematics	(2012)				
Master	Master's degree (1 major) Mathematics (2010)						
Master Master	's degri	ee (1 major) Economatnel ee (1 major) Mathematica	Il Physics (2011)				
Master	's degr	ee (1 major) Computation	al Mathematics (2012)	2)			

Module title					Abbreviation	
Study Group Robotic, Optimization and Control Theory					10-M=GROK-102-m01	
Module	e coord	inator		Module offered by		
Dean o	fStudie	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Registration for the s ning of the course o specified registratio ly be open for stude areas. Where applic	seminar must be ma r as announced by th n deadlines. Some s nts with previous kn able, details will be	de via SB@home at the begin- ne lecturer in accordance with the eminars or workshops might on- owledge and/or skills in certain specified in the class schedule.	
Conten	ts					
Selecte	ed mod	ern topics in robotics, op	timisation and contro	ol theory.		
Recom Knowle	mende dge of	d previous knowledge: the contents of the modu	ıle "Mathematical Co	ntrol Theory" or "Cor	ntrol Theory" is required.	
Intende	ed learı	ning outcomes				
The stu She ma	ident ga asters a	ains insight into contemp dvanced techniques in tl	orary research problenis field and can appl	ems in robotics, opti ly them to complex p	mization and control theory. He/ problems.	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + S (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Metho	d of ass	essment (type, scope, langua	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
module is	s creditab	le for bonus)				
At the t minar p sentati of one Langua	peginni present on of a candida ige of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 120 minutes ate each (approx. 20 min ssessment: German, Eng	urer will choose one minutes), b) written e , c) written examinati utes), e) oral examina lish	or two of the followin elaboration of conter ion (approx. 90 to 12 ation in groups (grou	ng methods of assessment: a) se- nts equivalent to a seminar pre- o minutes), d) oral examination ups of 2, approx. 30 minutes)	
Allocat	ion of p	olaces				
Additio	onal info	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master	's degr	ee (1 major) Mathematics	(2012)			
Master	Master's degree (1 major) Mathematics (2010)					
Master	's degre	ee (1 major) Economathe	matics (2011)			
Master	's degri	ee (1 major) Computation	al Mathematics (2012)	2)		

Module title					Abbreviation	
Study Group Mathematics in the Sciences					10-M=GMNW-122-m01	
Module coordinator				Module offered by		
Dean o	fStudi	es Mathematik (Mathema	atics) Institute of Mathematics			
ECTS Method of grading		Only after succ. compl. of module(s)				
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester		graduate	Registration for the seminar 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. 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	Its					
A modern topic in mathematics in the sciences. Recommended previous knowledge: Basic knowledge from the modules "Ordinary Differential Equations" and "Introduction to Partial Differential Equations" is recommended, as well as basic knowledge of functional analysis.						
Intende	ed lear	ning outcomes				
The stu advanc	ident ga ed tech	ains insight into contemp nniques in this field and o	orary research proble can apply them to cor	ems in mathematics nplex problems.	in the sciences. He/She masters	
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + S (r	no infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)	
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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 of 2 candidates (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						
Allocat	ion of p	olaces				
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) Mathematical Physics (2012)						
master's degree (1 major) Computational Mathematics (2012)						

Module title					Abbreviation
Study Group Number Theory				10-M=GZTH-102-m01	
Module coordinator				Module offered by	
Dean of	fStudi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. compl. of module(s)		
10	10 numerical grade				
Duratio	on	Module level	Other prerequisites		
1 semester		graduate	Registration for the seminar 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. 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				
Selected modern topics in number theory (e. g. algebraic number theory, modular forms, diophantine analysis). Recommended previous knowledge: Basic knowledge of algebra and number theory is assumed, such as can be acquired in the modules "Introducti-					
Intende	d loar	ning outcomes			
The stu	dent ga	ains insight into contemp	orary research proble	ems in numer theory	. He/She masters advanced tech-
niques	in this	field and can apply them	to complex problem	s	,
Course	S (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)	
V + S (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
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) l anguage 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' Master' Master'	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	
Current Topics in Mathematical Physics					11-EXMP5-122-m01	
Module coordinator				Module offered by		
chairpe Physik	rson of (Mathe	f examination committee matical Physics)	Mathematische	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. com	icc. compl. of module(s)		
5	nume	rical grade				
Duration Module level		Other prerequisites				
1 semes	ster	graduate	Approval by examination committee required.			
Conten	ts					
Current topics of Mathematical Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.						
Intende	d learr	ning outcomes				
The students have advanced competencies corresponding to the requirements of a module of Mathematical Phy- sics of the Master's programme. They have knowledge of a current subdiscipline of Mathematical Physics and understand the methods necessary to acquire this knowledge. They are able to classify the subject-specific con- texts and know the application areas.						
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
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 is creditable for bonus)						
a) written examination (approx. 120 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 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Language of assessment: German, English						
Allocation of places						
Additio	nal info	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Mathematical Physics (2012)						

Module title					Abbreviation		
Current Topics in Mathematical Physics					11-EXMP6-122-m01		
Module coordinator				Module offered by			
chairperson of examination committee <i>N</i> Physik (Mathematical Physics)			Mathematische	Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. com	. compl. of module(s)			
6	nume	rical grade					
Duration Module level		Other prerequisites					
1 semester		graduate	Approval by examination committee required.				
Content	ts						
Current topics of Mathematical Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.							
Intende	d learr	ning outcomes					
The students have advanced competencies corresponding to the requirements of a module of Mathematical Phy- sics of the Master's programme. They have knowledge of a current subdiscipline of Mathematical Physics and understand the methods necessary to acquire this knowledge. They are able to classify the subject-specific con- texts and know the application areas.							
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)			
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 is creditable for bonus)							
a) written examination (approx. 120 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 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)							
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) Mathematical Physics (2012)							
Module	title		Abbreviation				
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Current Topics in Mathematical Physics					11-EXMP7-122-m01		
Module coordinator				Module offered by			
chairpe Physik	rson of (Mathe	examination committee matical Physics)	Mathematische	Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)			
7	nume	rical grade					
Duration Module level		Other prerequisites					
1 semes	ster	graduate	Approval by examination committee required.				
Conten	ts						
Current topics of Mathematical Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.							
Intende	d learr	ning outcomes					
The students have advanced competencies corresponding to the requirements of a module of Mathematical Phy- sics of the Master's programme. They have knowledge of a current subdiscipline of Mathematical Physics and understand the methods necessary to acquire this knowledge. They are able to classify the subject-specific con- texts and know the application areas.							
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)			
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 is creditable for bonus)							
a) written examination (approx. 120 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 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Language of assessment: German, English							
Allocation of places							
Additio	nal info	ormation					
Workload							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master's degree (1 major) Mathematical Physics (2012)							

Module	title		Abbreviation				
Current Topics in Mathematical Physics					11-EXMP8-122-m01		
Module coordinator				Module offered by			
chairpe Physik	rson of (Mathe	examination committee matical Physics)	Mathematische	Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. com	ipl. of module(s)			
8	nume	rical grade					
Duration Module level		Other prerequisites					
1 semes	ster	graduate	Approval by examination committee required.				
Conten	ts						
Current topics of Mathematical Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.							
Intende	ed learr	ning outcomes					
The students have advanced competencies corresponding to the requirements of a module of Mathematical Phy- sics of the Master's programme. They have knowledge of a current subdiscipline of Mathematical Physics and understand the methods necessary to acquire this knowledge. They are able to classify the subject-specific con- texts and know the application areas.							
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)			
R (no in	format	ion on SWS (weekly cont	act hours) and cours	e language available)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)							
a) written examination (approx. 120 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Language of assessment: German. English							
Allocation of places							
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Additio	nal info	ormation					
Workload							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master's degree (1 major) Mathematical Physics (2012)							





Thesis (30 ECTS credits)

Module	title		Abbreviation			
Master Thesis Mathematical Physics					11-MA-MP-122-m01	
Module coordinator				Module offered by		
chairperson of examination committee Mathematische Physik (Mathematical Physics)				Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. compl. of module(s)			
30	nume	rical grade				
Duration Module level		Other prerequisites				
1 seme	ster	graduate				
Conten	ts					
Mostly independent processing of a task in the field of Mathematical Physics, especially according to known pro- cedures and scientific aspects; writing of the thesis.						
Intende	ed leari	ning outcomes				
The students are able to independently work on a task from Mathematical Physics, especially according to known methods and scientific aspects and to summarise their results in a final paper.						
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
no cour	rses as	signed				
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether						
module is creditable for bonus)						
written thesis Language of assessment: German, English						
Allocation of places						
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Mathematical Physics (2012)						