

# Module Catalogue

for the Subject

## **Mathematical Physics**

as a Bachelor's with 1 major with the degree "Bachelor of Science" (180 ECTS credits)

Examination regulations version: 2009 Responsible: Institute of Mathematics Responsible: Faculty of Physics and Astronomy

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record 82|b55|-|-|H|2009

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## The subject is divided into

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### **Content and Objectives of the Programme**

The Bachelor programme in Mathematical Physics is offered by the Department of Mathematics, jointly with the Faculty of Physics and Astronomy, with a total of currently (SS 2010) 9 resp. 13 chairs.

At the end of this course of study, the student should be familiar with the main branches of mathematical physics, taught methods of both mathematical and physical reasoning and working as well as analytical thinking, abstract concepts and the ability to recognize and construct complex structures and interconnections.

Through the course these skills which the students acquire provide the basic knowledge required for analyzing and solving subsequently the various problems they encounter, and in particular for obtaining a consecutive Bachelor-Masters degree. Therefore, the main emphasis is put on the comprehension of fundamental mathematical and physical notions and principles, the knowledge of a variety of methods, the development of analytical reasoning and abstraction, and the capacity of a qualitative understanding of complex structural interconnections, rather than a detailed quantitative knowledge of many facts in mathematics and physics.

For the Bachelor thesis the student should work on a thematic and temporally closely limited frame in order to carry out a special task in mathematical physics, using well-known procedures and scientific criteria under guidance but, to a large extent, independently.

The exam should ascertain whether the candidate overlooks the context of the basics in mathematical physics and possesses the ability to apply the corresponding scientific methods. The exam should lead to an internationally comparable degree in mathematical physics and provides the means for entry into the working world. In the framework of a consecutive Bachelor-Masters degree it may also be used as preparation for further Masters study.

### 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)):

#### 20-Jan-2011 (2011-12)

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**

(118 ECTS credits)



## Mathematics (59 ECTS credits)

Bachelor's with 1 major Mathematical Physics (2009)

Module title			Abbreviation			
Propaedeutics of Mathematics				10-M-PPM-082-m01		
Module coordinator				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)		
2	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate		Admission prerequisite to assessment: regular attendance of courses (as specified at the beginning of the course).		
Conten	ts					
		proof methods and quest g. by reference to its histo			es of abstract concepts of ma- c and deduction.	
Intende	ed lear	ning outcomes				
	asy mat				nematics. He/She is able to per- y and reasonably in written and	
Course	<b>S</b> (type, r	number 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	urse language avail	able)	
		<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
Assess	ment o	ments (type and expend ffered: once a year, winte ssessment: German, Eng	er semester		r at the beginning of the course)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module appears in						
		ree (1 major) Mathematic	s (2008)			
	-	ree (1 major) Economathe				
	-	ree (1 major) Economathe				
	-	ree (1 major) Mathematic	• •	)		
	-	ree (1 major) Computatio gree (1 major, 1 minor) Ma		•		
First state examination for the teaching degree Gymnasium Mathematics (2009)						

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Module title					Abbreviation	
Analysi	s				10-M-ANA-082-m01	
Module	coord	inator		Module offered by		
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
17	nume	rical grade				
Duratio		Module level	Other prerequisites			
2 seme		undergraduate		f exception, additional prerequisites are listed in the section on		
Conten	ts					
ries, po	wer se	ries, Taylor series, funda	mental calculus in on	e and several variab	ivergence of sequences and se- ples (including inverse and impli- ntegral and improper integrals).	
Intende	ed lear	ning outcomes				
mathen	natical	arguments and present t	hem adequately in w	ritten and oral form.	He/She is able to perform easy . He/She is acquainted with the geometric interpretation.	
Courses	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
<ul> <li>component.</li> <li>10-M-ANA-1-082: V + Ü (no information on SWS (weekly contact hours) and course language available)</li> <li>10-M-ANA-2-082: V + Ü (no information on SWS (weekly contact hours) and course language available)</li> <li>10-M-ANA-P-082: M (no information on SWS (weekly contact hours) and course language available)</li> <li>Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether</li> </ul>						
		le for bonus)				
	less st	ated otherwise, successf			e components as specified be- successful completion of all indi-	
<ul> <li>8</li> <li>a)</li> <li>(a)</li> <li>(a)</li> <li>0</li> <li>Assession</li> <li>7</li> <li>a)</li> <li>(a)</li> <!--</td--><td>ECTS, ) writte approx anguag ther pr <b>ment in</b> ECTS, ) writte approx anguag ther pr ent 10- <b>ment in</b> ECTS, ral exa anguag nly aft ule cor</td><td>20 minutes) or c) oral ex ge of assessment: Germa rerequisites: Modules 10- <b>n module component 10-</b> Method of grading: (not) n examination (approx. 9 . 20 minutes) or c) oral ex ge of assessment: Germa rerequisites: Modules 10- M-ANA-1 is recommende <b>n module component 10-</b> Method of grading: nume mination of one candidat ge of assessment: Germa er successful completion</td><td>successfully complete o minutes; usually ch kamination in groups n, English if agreed u M-VKM and 10-M-PPI <b>M-ANA-2-082:</b> Analys successfully complete o minutes; usually ch kamination in groups n, English if agreed u -M-VKM and 10-M-PP d for module compor <b>M-ANA-P-082:</b> Exami erical grade te each (approx. 30 m n, English if agreed u o f module compone D-M-ANL-1, 10-M-ANA-</td><td>ted (groups of 2, approx pon with the examin M are recommended sis 2 Analysis 2 ted (groups of 2, approx pon with the examin M are recommended nent 10-M-ANA-2. nation in Analysis ninutes) pon with the examinents: Successful con</td><th>ner l. nination of one candidate each x. 30 minutes) ner d; in addition, module compo-</th></ul>	ECTS, ) writte approx anguag ther pr <b>ment in</b> ECTS, ) writte approx anguag ther pr ent 10- <b>ment in</b> ECTS, ral exa anguag nly aft ule cor	20 minutes) or c) oral ex ge of assessment: Germa rerequisites: Modules 10- <b>n module component 10-</b> Method of grading: (not) n examination (approx. 9 . 20 minutes) or c) oral ex ge of assessment: Germa rerequisites: Modules 10- M-ANA-1 is recommende <b>n module component 10-</b> Method of grading: nume mination of one candidat ge of assessment: Germa er successful completion	successfully complete o minutes; usually ch kamination in groups n, English if agreed u M-VKM and 10-M-PPI <b>M-ANA-2-082:</b> Analys successfully complete o minutes; usually ch kamination in groups n, English if agreed u -M-VKM and 10-M-PP d for module compor <b>M-ANA-P-082:</b> Exami erical grade te each (approx. 30 m n, English if agreed u o f module compone D-M-ANL-1, 10-M-ANA-	ted (groups of 2, approx pon with the examin M are recommended sis 2 Analysis 2 ted (groups of 2, approx pon with the examin M are recommended nent 10-M-ANA-2. nation in Analysis ninutes) pon with the examinents: Successful con	ner l. nination of one candidate each x. 30 minutes) ner d; in addition, module compo-	

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(2009)	ta record Bachelor (180 ECTS) Mathematische Physik - 2009	

#### Allocation of places

#### Additional information

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#### Workload

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#### Teaching cycle

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

§ 73 (1) 1. Mathematik Analysis

#### Module appears in

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

Bachelor' degree (1 major) Mathematics (2008)

Bachelor' degree (1 major) Economathematics (2009)

Bachelor' degree (1 major) Economathematics (2008)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Computational Mathematics (2009)

Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)

Modul	e title				Abbreviation
Linear Algebra				10-M-LNA-082-m01	
Modul	e coord	inator		Module offered by	
Dean of Studies Mathematik (Mathematics)		atics)	Institute of Mathem	natics	
ECTS	S Method of grading Only after succ. compl. of module(s		npl. of module(s)		
14	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
2 seme	ester	undergraduate	By way of exception, additional prerequisites are listed in the section on assessments.		
<u> </u>					

#### Contents

Sets, relations and maps; notions of groups, rings and fields (in particular, polynomial rings); vector spaces (subspaces, quotient spaces, linear independency, basis, dimension); linear maps (isomorphism theorem, image, kernel, rank); matrix calculus; systems of linear equations, determinants, eigenvalues, eigenvectors and eigenspaces, diagonalisability (including characteristic polynomial, minimal polynomial), normal forms, bilinear forms; Euclidean and unitary vector spaces (orthonormal bases, isometries, principal axis transformation).

#### Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is able to perform easy mathematical arguments independently, and can present them adequately in written and oral form. He/She is able to apply the central proof methods and concepts of linear algebra and knows about their algebraic and geometric background.

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

This module comprises 3 module components. Information on courses will be listed separately for each module component.

- 10-M-LNA-1-082: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 10-M-LNA-2-082: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 10-M-LNA-P-082: M (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)

Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

Assessment in module component 10-M-LNA-1-082: Linear Algebra 1 Linear Algebra 1

- 7 ECTS, Method of grading: (not) successfully completed
- written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)
- Language of assessment: German, English if agreed upon with the examiner
- Other prerequisites: Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-LNA-2-082: Linear Algebra 2 Linear Algebra 2

- 5 ECTS, Method of grading: (not) successfully completed
- written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)
- Language of assessment: German, English if agreed upon with the examiner

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Other prerequisites: Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-LNA-P-082: Examination in Linear Algebra

- 2 ECTS, Method of grading: numerical grade
- oral examination of one candidate each (approx. 30 minutes)
- Language of assessment: German, English if agreed upon with the examiner
- Only after successful completion of module components: Successful completion of module component 10-M-LNA-1 or module component 10-M-LNA-2 is a prerequisite for participation in module component 10-M-LNA-P.

#### Allocation of places

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Additional information

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Workload

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**Teaching cycle** 

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

§ 73 (1) 2. Mathematik Lineare Algebra, Algebra und Elemente der Zahlentheorie

#### Module appears in

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

Bachelor' degree (1 major) Mathematics (2008)

Bachelor' degree (1 major) Economathematics (2009)

Bachelor' degree (1 major) Economathematics (2008)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Computational Mathematics (2009)

Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)

First state examination for the teaching degree Gymnasium Mathematics (2009)

	tle			Abbreviation	
Ordinary Differential Equations and Complex Analysis 10-M-DFT-082-mo1					
Module coordinator Modu			Module offered by		
Dean of S	tudies Mathematik (M	athematics)	Institute of Mathem	natics	
ECTS M	lethod of grading	Only after succ. co	ompl. of module(s)		
13 n	umerical grade				
Duration	Module level	Other prerequisit	es		
2 semeste	er undergraduate	By way of exception assessments.	of exception, additional prerequisites are listed in the section on		
Contents					
ons, basic functions plex analy Intended	c notions in the qualita , meromorphic functio ysis, applications in co learning outcomes	ative theory of ordinary dif ns and conformal maps, b omputer science, physics,	ferential equations, ba basic proof methods in engineering science a	f nonlinear differential equati- asic properties of holomorphic differential equations and com- nd other fields of mathematics. heory of ordinary differential	
equations	and holomorphic fun		nterconnect these con	cepts and realises the advanta-	
Courses (t	ype, number of weekly conta	ct hours, language — if other than (	German)		
• 10-l • 10-l	M-DFT-1-082: V + Ü (no M-DFT-2-082: V + Ü (no	information on SWS (wee information on SWS (wee		l course language available)	
Assessme low. Unles	<b>f assessment</b> (type, scopeditable for bonus) ent in this module com	prises the assessments ir	r contact hours) and co n, examination offered — if no n the individual modul		
Assessme low. Unles vidual ass Assessme ons	f assessment (type, scop editable for bonus) ent in this module com ss stated otherwise, su sessments. ent in module compon	e, language — if other than Germa prises the assessments ir uccessful completion of th	r contact hours) and co n, examination offered — if no n the individual modul ne module will require nary Differential Equat	ourse language available) ot every semester, information on whether e components as specified be-	

- 7 ECTS, Method of grading: (not) successfully completed
- written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)

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- Language of assessment: German, English if agreed upon with the examiner
- Other prerequisites: Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-DFT-P-082: Examination in Ordinary Differential Equations and Complex Analysis

- 2 ECTS, Method of grading: numerical grade
- oral examination of one candidate each (approx. 30 minutes)
- Language of assessment: German, English if agreed upon with the examiner
- Only after successful completion of module components: Successful completion of module component 10-M-DFT-1 or module component 10-M-DFT-2 is a prerequisite for participation in module component 10-M-DFT-P.

Allocation of places

Additional information

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Workload

--

Teaching cycle

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

§ 73 (1) 1. Mathematik Analysis

#### Module appears in

Bachelor' degree (1 major) Mathematics (2008)

Bachelor' degree (1 major) Economathematics (2009)

Bachelor' degree (1 major) Economathematics (2008)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Computational Mathematics (2009)

Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)

First state examination for the teaching degree Gymnasium Mathematics (2009)

Bachelor's with 1 major Mathematical Physics	
(2009)	

Module title			Abbreviation		
Geometric Analysis and Partial Differential Equations			10-M-GAP-092-m01		
Module coordinator				Module offered by	
Dean of Studies Mathematik (Mathematic		atics)	Institute of Mathematics		
ECTS	5 Method of grading Only after succ. compl. of		npl. of module(s)		
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
2 seme	ster	undergraduate	By way of exception, additional prerequisites are listed in the section on assessments.		

#### Contents

Basics in analysis on manifolds, e. g. submanifolds and calculus of differential forms, Stoke's theorem and its applications in vector calculus and topology, examples of first order partial differential equations, existence and uniqueness theorems, basic equations in mathematical physics, boundary value theorems, maximum principle and Dirichlet problem.

#### Intended learning outcomes

The student knows and masters the basic notions and essential methods of vector analysis on manifolds and partial differential equations. He/She is able to perform mathematical arguments in this field independently, and can present them adequately in written and oral form. He/She is able to apply the central proof methods and concepts of geometric analysis and partial differential equations and knows about their analytic background.

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

This module comprises 3 module components. Information on courses will be listed separately for each module component.

- 10-M-GAP-1-092: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 10-M-GAP-2-092: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 10-M-GAP-P-092: M (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)

Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

Assessment in module component 10-M-GAP-1-092: Geometric Analysis Geometric Analysis

- 7 ECTS, Method of grading: (not) successfully completed
- a) written examination (approx. 90 minutes; usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)
- Language of assessment: German, English if agreed upon with the examiner
- Other prerequisites: Modules 10-M-ANA and 10-M-LNA are recommended.

Assessment in module component 10-M-GAP-2-092: Partial Differential Equations Partial Differential Equations

- 4 ECTS, Method of grading: (not) successfully completed
- a) written examination (approx. 90 minutes; usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)
- Language of assessment: German, English if agreed upon with the examiner
- Other prerequisites: Modules 10-M-ANA and 10-M-LNA are recommended.

**Assessment in module component 10-M-GAP-P-092:** Examination in Geometric Analysis and Partial Differential Equations

- 2 ECTS, Method of grading: numerical grade
- oral examination of one candidate each (approx. 30 minutes)
- Language of assessment: German, English if agreed upon with the examiner
- Only after successful completion of module components: 10-M-GAP-1 or 10-M-GAP-2
- Other prerequisites: Modules 10-M-ANA and 10-M-LNA are recommended.

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#### Allocation of places

#### Additional information

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Workload

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#### Teaching cycle

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

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#### Module appears in

Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009)



# **Physics** (59 ECTS credits)

For students interested in participating in the FOKUS programme, module 11-TQM-F will replace module 11-TQM. Module component 11-TQM-F-2, which will prepare students for studying in the Master's programme FOKUS Physik (FOKUS Physics), will be offered in the form of a block course between the lecture periods of the winter and summer semesters (for students who took up studies in winter semester, block course will be offered between third and fourth subject semester).

Module title			Abbreviation			
Classical Physics (Mechanics, Thermodynamics, Waves, Oscillations, Electric					11-KP-092-m01	
ty, Mag	netism	and Optics)				
Module	coord	inator		Module offered by		
Managi	ng Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
16	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
2 seme	ster	undergraduate	-	ematische Rechenme sics) for first-semeste	ethoden der Physik ( er students.	Mathemati-
Conten	ts					
gnetic v tion. Int Non-lin rent. Me	vibratio teractic earity a echanis	of mechanics, thermody ons and waves, radiation ons and central forces. G and chaos. Mechanics o sms of conduction. Mag ent. Electromagnetic way	and wave optics. Tim ieneral relativity. Mecl f non-rigid bodies. Ga netostatics. Electroma	e, room and motion hanics of rigid bodie sses. Thermodynami agnetic induction. Ma	. Physical values. For s. Friction. Vibration ics. Electrostatics. Electrostatics.	ce and mo- and waves. ectric cur-
Intende	ed learn	ning outcomes	· · · · · ·			
ves, sci are able	ence o e to ap	understand the basic pri f electricity, magnetism, ply mathematical metho the solution of mathema	electromagnetic vibra ds to the formulation	ations and waves, ra	diation and wave op	tics. They
Course	<b>5</b> (type, n	umber of weekly contact hours,	language — if other than Ger	rman)		
tact hou Klassis	urs) + Ü che Phy	ysik 1 (Mechanik, Weller İ (2 weekly contact hour ysik 2 (Elektromagnetisr ) + Ü (2 weekly contact h	s), once a year (winter nus, Optik) (Classical	r semester) Physics 2 (Electroma		
		s <b>essment</b> (type, scope, langu le for bonus)	age — if other than German, e	examination offered — if no	t every semester, informatio	on on whether
1. Topic on (a 2. Topic tion ( 3. Topic	s cove pprox. cs cove ápprox s cove	as the following assess red in lectures and exerce 120 minutes). red in lectures and exerce (, 120 minutes). red in lectures and exerce ually chosen) or written	cises in part 1 (Klassis cises in part 2 (Klassis cises in parts 1 and 2:	sche Physik 2 (Classi oral examination of	cal Physics 2)): writte	en examina-
Assessment component 3 will be offered in German; English if agreed upon with examiner(s). Successful completion of approx. 50% of practice work each is a prerequisite for admission to assessment com- ponents 1 and 2. To qualify for admission to assessment component 3, students must pass assessment component 1 and/or 2. Students are highly recommended to attend both courses Klassische Physik 1 (Classical Physics 1) and Klassi- sche Physik 2 (Classical Physics 2). The topics discussed in these two courses will be covered in assessment component 3. Students must register for assessment components 1 through 3 online (details to be announced). To pass this module, students must first pass assessment component 1 or 2 and must then pass assessment component 3. The grade achieved in assessment component 1 or 2 (whichever is better) and the grade achieved in assessment component 3 will each count 50% towards the overall grade awarded for the module.						
Allocat	ion of p	olaces				
Bachelor's ( (2009)	with 1 maj	or Mathematical Physics		generated 26-Aug-2024 • exa r (180 ECTS) Mathematische F	-	page 19 / 156

dditional information
orkload
eaching cycle
eferred to in LPO I (examination regulations for teaching-degree programmes)
odule appears in
achelor' degree (1 major) Mathematics (2012)
achelor' degree (1 major) Mathematics (2013)
achelor' degree (1 major) Physics (2010)
achelor' degree (1 major) Physics (2012)
achelor' degree (1 major) Nanostructure Technology (2010)
achelor' degree (1 major) Nanostructure Technology (2012)
achelor' degree (1 major) Mathematical Physics (2009)
achelor' degree (1 major) Mathematical Physics (2012)
achelor' degree (1 major) Computational Mathematics (2012)
achelor' degree (1 major) Computational Mathematics (2013)
achelor's degree (1 major, 1 minor) Physics (Minor, 2010)
o final examination Special study offering (2010)

Module title			Abbreviation			
Statisti	ical Me	chanics, Thermodynam	ics and Electrodynam	lics	11-STE-092-m01	
Module	e coord	inator		Module offered by	<u> </u>	
Managi and Asi		ector of the Institute of T sics	heoretical Physics	Faculty of Physics a	and Astronomy	
ECTS		od of grading	Only after succ. co	mpl. of module(s)		
16	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
2 seme	ster	undergraduate	10-M1-PHY and 10-I	M2-PHY or 10-M1-NST	and 10-M2-NST	
Conten	ts					
ticles, d	critical	tatistical Physics: Ideal phenomena, Maxwell e tromagnetic fields. Spe	quations, electrostati			
Intende	ed lear	ning outcomes				
trodyna	amics, t	nave advanced knowlec hermodynamics and st are able to independen	atistical mechanics. T	hey are familiar with	the corresponding of	calculation
		umber of weekly contact hours		•	•	
hours) Theore	+ Ü (2 \ tische l	echanik und Thermody veekly contact hours), c Elektrodynamik (Theore vyear (summer semeste	once a year (winter sei tical Electrodynamics)	mester)		
		<b>eessment</b> (type, scope, langu le for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informa	tion on whether
1. Topic chan 2. Topic mics 3. Topic	cs cove ics and cs cove )): writh cs cove	as the following assess red in lectures and exer I Thermodynamics)): wr red in lectures and exer een examination (approx red in lectures and exer ually chosen) or written	rcises in part 1 (Statist itten examination (ap rcises in part 2 (Theor x. 120 minutes). rcises in parts 1 and 2	prox. 120 minutes). etische Elektrodynan : oral examination of	nik (Theoretical Elec	trodyna-
Succes ponent Studen cal Meo discuss Studen To pass compos The gra	sful co s 1 and ts are h chanics sed in t ts mus s this m nent 3. de ach	omponent 3 will be offe mpletion of approx. 50% 2. highly recommended to 5 and Thermodynamics) hese two courses will b t register for assessmer hodule, students must f ieved in assessment co will each count 50% tow	6 of practice work eac attend both courses 9 and Theoretische Ele e covered in assessm at components 1 throu irst pass assessment mponent 1 or 2 (whicl	th is a prerequisite for Statistische Mechani ktrodynamik (Theore ent component 3. Igh 3 online (details t component 1 or 2 an hever is better) and t	r admission to asse k und Thermodynan tical Electrodynamic to be announced). d must then pass as he grade achieved in	nik (Statisti- cs). The topic: ssessment
Allocat		-				
Additio	nal inf	ormation				
Worklo	ad					
-						
achelor's	with 1 ma	or Mathematical Physics	IMU Würzburg	• generated 26-Aug-2024 • ex	am. reg. da-	page 21 / 156
2009)				or (180 ECTS) Mathematische		

#### Teaching cycle

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

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#### Module appears in

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Nanostructure Technology (2010)

Bachelor' degree (1 major) Mathematical Physics (2009)

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

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

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

Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module title			Abbreviation			
Theoret	tical M	echanics and Quantum N	<b>Nechanics</b>		11-TQM-092-m01	
Module	e coord	inator		Module offered by		
Managi and Ast	-	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)		
16		rical grade		•		
Duratio		Module level	Other prerequisites			
		undergraduate			o M1 NST 10 M2 NST and MPLa	
Problen Limits c cillator. ny-parti	iian me ns of co of class . Angul icle sys	entral forces, minor vibra ical physics. Schrödinge ar momentum and spin. I stems.	tions, rigid body, mo r equation, mathema	tion in electromagne tical principles of qu	conservation laws. Applications: tic fields. Relativistic dynamics. lantum mechanics, harmonic os- on. Motion in electric fields. Ma-	
Intende	ed leari	ning outcomes				
miliar w of quan	vith the itum th retical	e principles of theoretical eory. They are able to ap	mechanics and their ply the acquired calc	r different formulatio ulation methods and	Theoretical Physics. They are fa- ns and understand the principles I techniques to simple problems I knowledge of basic mathemati-	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ge	rman)		
year (w	inter se nmech	emester) anik (Quantum Mechanie			(2 weekly contact hours), once a kly contact hours), once a year	
		s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, information on whether	
<ol> <li>Topic amin</li> <li>Topic tion ( 3. Topic</li> </ol>	<ul> <li>This module has the following assessment components</li> <li>1. Topics covered in lectures and exercises in part 1 (Theoretische Mechanik (Theoretical Mechanics)): written examination (approx. 120 minutes).</li> <li>2. Topics covered in lectures and exercises in part 2 (Quantenmechanik (Quantum Mechanics)): written examination (approx. 120 minutes).</li> <li>3. Topics covered in lectures and exercises in parts 1 and 2: oral examination of one candidate each (approx. 30 minutes, usually chosen) or written examination (approx. 120 minutes).</li> </ul>					
Successful completion of approx. 50% of practice work each is a prerequisite for admission to assessment com- ponents 1 and 2. To qualify for admission to assessment component 3, students must pass assessment component 1 and/or 2. Students are highly recommended to attend both courses Theoretische Mechanik (Theoretical Mechanics) and Quantenmechanik (Quantum Mechanics). The topics discussed in these two courses will be covered in as- sessment component 3. Students must register for assessment components 1 through 3 online (details to be announced). To pass this module, students must first pass assessment component 1 or 2 and must then pass assessment component 3. The grade achieved in assessment component 1 or 2 (whichever is better) and the grade achieved in assessment component 3 will each count 50% towards the overall grade awarded for the module.						
Allocat	ion of p	olaces				
·						

Additional information
Workload
Teaching cycle
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)
Module appears in
Bachelor' degree (1 major) Mathematics (2012)
Bachelor' degree (1 major) Mathematics (2013)
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)
Bachelor' degree (1 major) Computational Mathematics (2012)
Rechalar degree (a major) Computational Mathematics (2010)
Bachelor' degree (1 major) Computational Mathematics (2013)

Module	e title				Abbreviation	
Theore	Theoretical Mechanics and Quantum Mechanics for FOKUS			5 Students	11-TQM-F-092-m01	
Module coordinator			Module offered by			
-	ing Dire trophys	ctor of the Institute of ics	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	d of grading	Only after succ. co	mpl. of module(s)		
16		ical grade	10-M-PHY1 and 10-1 11-KP	M-PHY2 or 10-M-NST	1 and 10-M-NST2 and	d 11-TQM-1,
Duratio	on	Module level	Other prerequisites	S		
2 seme	ester	undergraduate				
Conten	its					
Probler Limits of cillator	ms of ce of class	chanics. Lagrangian ar entral forces, minor vib ical physics. Schröding ar momentum and spin tems	rations, rigid body, mo er equation, mathema	otion in electromagne atical principles of qu	etic fields. Relativist uantum mechanics,	ic dynamics. harmonic os-
Intende	ed learr	ing outcomes				
miliar v of quar	with the ntum th pretical	nave gained first experi principles of theoretic eory. They are able to a Physics and to interpre	al mechanics and thei pply the acquired calo	ir different formulation methods and	ons and understand d techniques to sim	the principles ple problems
Course	<b>S</b> (type, n	umber of weekly contact hours	, language — if other than Ge	erman)		
Quante + Ü (2 v ween s Methoo	enmech weekly ummer d of ass	emester) anik für FOKUS-Studier contact hours) + T (1 we and winter semester) essment (type, scope, lang le for bonus)	ekly contact hour), or	nce a year (block tauş	ght during semester	break bet-
1. Topio amir 2. Topio chan 3. Topio	cs cove nation ( cs cove nics for cs cove	as the following assess red in lectures and exe approx. 120 minutes). red in lectures and exe FOKUS Students)): writh red in lectures and exe ually chosen) or writter	rcises in part 1 (Theore rcises in part 2 (Quant ten examination (appr rcises in parts 1 and 2	tenmechanik für FOK rox. 120 minutes). : oral examination of	US-Studierende (Qu	antum Me-
ponent To qua Studen Quante these t Studen To pass compo The gra compo	is 1 and lify for a sts are h enmech wo cou its mus s this m nent 3. ade ach nent 3.	admission to assessme highly recommended to anik für FOKUS-Studier rses will be covered in a t register for assessmen odule, students must f ieved in assessment co will each count 50% tow	nt component 3, stud attend both courses ende (Quantum Mech assessment compone nt components 1 throu irst pass assessment mponent 1 or 2 (which	ents must pass asse Theoretische Mechar anics for FOKUS Stud nt 3. Igh 3 online (details component 1 or 2 an hever is better) and t	ssment component i nik (Theoretical Mecl dents). The topics di to be announced). d must then pass as he grade achieved in	1 and/or 2. hanics) and scussed in sessment
Allocat	ion of p	laces				
		or Mathematical Physics		• generated 26-Aug-2024 • e>		page 25 / 156

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#### Additional information

Students who intend to study the FOKUS Master's degree programme must take Quantenmechanik für FO-KUS-Studierende (Quantum Mechanics for FOKUS Students) instead of Quantenmechanik (Quantum Mechanics).

#### Workload

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#### Teaching cycle

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

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#### Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012)

Module title			Abbreviation			
Practic	al Cour	se Part B Mathematical	Physics		11-P-PB-MP-092-mc	)1
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
6	(not) s	successfully completed	11-P-PA			
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Physical laws of mechanics, thermodynamics, optics, science of electricity, vibration and waves, Atomic and Nuclear Physics, wave optics. Basic measuring methods using computers and storage oscilloscopes.						
Intend	ed learr	ning outcomes				
are abl	e to ind	nave knowledge and ski lependently plan and co nent protocol.		-		
Course	<b>S</b> (type, n	umber of weekly contact hours	, language — if other than Ger	rman)		
Elektriz Wellen Atom-	zitätslei optik (F und Ker	ysik (Classical Physics, nre und Schaltungen (El Physical Optics, WOP): F nphysik (Atomic and Nu Messtechnik (Compute	ectricity and Circuits, 2 (2 weekly contact hou uclear Physics, AKP): P	ELS): P (2 weekly cor urs) (2 weekly contact he	ours)	ours)
-		essment (type, scope, langu			•	
		le for bonus)			, ,	
1. Lab ly co phys 2. Lab ly co	course i mplete sics-rela course i mplete	as the following assess in part 1: a) Preparing, p d if a Testat (exam) is pa ited contents of the cou in part 2: a) Preparing, p d if a Testat (exam) is pa ited contents of the cou	erforming and evaluat assed. b) Talk (with di rse (approx. 30 minut performing and evalua assed. b) Talk (with di	scussion) to test the es). ting the experiments scussion) to test the	students' understan will be considered s	iding of the successful-
Studen nent, tl To pass Studen AKP an	its will l ney mus s this m its mus d CMT.	t register for assessmer be offered one opportur st pass both elements a odule, students must s t take exactly one cours Students must attend k odule, students must p	ity to retake element a ) and b). uccessfully complete t e each in the areas KL (LP or ELS courses pric	a) and/or element b) two out of the five co P and ELS as well as or to attending WOP,	. To pass an assessr urses. one course in the ar AKP or CMT courses.	nent compo- reas WOP,
Allocat	ion of p	olaces				
Additio	onal info	ormation				
Workload						
Teaching cycle						
Referre	ed to in	LPOI (examination regulatio	ns for teaching-degree progra	mmes)		
		hysik Mechanik, Wärme			len Relativitätstheor	ie
		or Mathematical Physics		generated 26-Aug-2024 • exa		page 27 / 156
(2009)	,			r (180 ECTS) Mathematische F		

§ 53 (1) 1. b) Physik Aufbau der Materie

- § 53 (1) 1. c) Physik physikalische Grundpraktika
- § 77 (1) 1. b) Physik "Fortgeschrittene Experimentalphysik"
- § 77 (1) 1. d) Physik "physikalische Praktika"

#### Module appears in

Bachelor' degree (1 major) Mathematical Physics (2009)

Module title				Abbreviation			
Practic	al Cour	se A			11-P-PA-092-m01		
Module	e coord	inator		Module offered by			
Managi	ing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
5	(not) s	successfully completed					
Duratio	n	Module level	Other prerequisites				
1 seme	ster	undergraduate					
Conten	Contents						
Physical laws of mechanics, thermodynamics, science of electricity, types of error, error approximation and pro- pagation, graphs, linear regression, average values and standard deviation, distribution functions, significance tests, writing of lab reports and publications.							
Intende	ed leari	ning outcomes					
le to in measu	depenc ring pro	lently plan and conduct e	experiments, to cooperation of the second seco	erate with others, an g results on the basi	menting techniques. They are ab- d to document the results in a s of error propagation and of the		
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)			
Ü (1 we Beispie	ekly co ele aus	ntact hour), once a year (	(winter semester)		ysis): V (1 weekly contact hour) + hermodynamics and Electricity,		
Method	d of ass	s <b>essment</b> (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)					
1. Topic 2. Lab c ted if	cs cove course: f a Test		ises: written examina and evaluating the e alk (with discussion)	experiments will be c	inutes) onsidered successfully comple- understanding of the physics-re-		
1.					ission to assessment component . Students will be offered one op-		
portuni Studen	ty to re ts mus	take element a) and/or e t register for assessment	lement b). components 1 and 2	online (details to be			
re atter Electric	nding B ity).	eispiele aus Mechanik, V	Värmelehre und Elekt	rik (Examples from I	Mechanics, Thermodynamics and		
		odule, students must pa	ss both assessment	component 1 and as	sessment component 2.		
Allocation of places							
Additional information							
Worklo	ad						
Teachi	ıg cycl	9					

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

§ 53 (1) 1. a) Physik Mechanik, Wärmelehre, Elektrizitätslehre, Optik, der speziellen Relativitätstheorie

§ 53 (1) 1. c) Physik physikalische Grundpraktika

§ 77 (1) 1. d) Physik "physikalische Praktika"

#### Module appears in

Bachelor' degree (1 major) Mathematics (2014) Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2014) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2014) Bachelor' degree (1 major) Aerospace Computer Science (2014) Bachelor' degree (1 major) Aerospace Computer Science (2014) Bachelor' degree (1 major, 1 minor) Physics (Minor, 2010) No final examination Special study offering (2010)

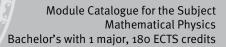


## **Compulsory Electives**

(32 ECTS credits)

Students must achieve a minimum of 8 ECTS credits in each of the module areas Mathematik (Mathematics) and Physik (Physics). To achieve the remaining 16 ECTS credits, students are to complete additional modules in these two areas (any modules in the respective areas may be selected).





## Mathematics

(ECTS credits)

Module	Module title				Abbreviation
Semina	r in An	alysis			10-M-BSA-072-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	undergraduate			
Conten	ts				
A selec	ted top	ic in analysis.			
Intende	ed learn	ning outcomes			
of a giv ly in a s	en topi scientif	c using selected literatur c discussion.	e, and prepares a tal	k on the subject. He	sters elaboration and structuring /She is able to participate active-
		umber of weekly contact hours, l			
S (no in	format	ion on SWS (weekly cont	act hours) and cours	e language available	
		essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
Assess	ment o	o minutes) ffered: in the semester in ssessment: German, Eng			
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ng cycl	9			
		LPOI (examination regulations	for teaching-degree progra	mmes)	
§ 73 (1)	1. Mat	hematik Analysis			
Module appears in					
Bachelor' degree (1 major) Mathematics (2008)					
	Bachelor' degree (1 major) Mathematics (2007)				
	Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008)				
	Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009)				
	Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009)				
		gree (1 major, 1 minor) Ma			
		mination for the teaching			)

10-M-BSL-072-m01				
Module offered by				
Institute of Mathematics				
succ. compl. of module(s)				
equisites				
nt scientific work. He/She masters elaboration and structuring ares a talk on the subject. He/She is able to participate active				
ther than German)				
and course language available)				
an German, examination offered — if not every semester, information on whether				
course is offered ed upon with the examiner				
egree programmes)				
id Elemente der Zahlentheorie				
Module appears in				
Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)				

Module	Module title Abbreviation				
Semina	r in Al	gebra			10-M-BSE-072-m01
Module	coord	inator		Module offered by	<u> </u>
Dean of	f Studi	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	undergraduate			
Conten	ts				
A selec	ted top	oic in algebra.			
Intende	ed leari	ning outcomes			
of a giv	en topi				sters elaboration and structuring /She is able to participate active-
Course	<b>S</b> (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)
Method	l of ass	<b>Sessment</b> (type, scope, langua	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
		le for bonus)			
Assess	ment o	50 minutes) ffered: in the semester in ssessment: German, Eng			
Allocat	-				
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ıg cycl	e			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
§ 73 (1)	§ 73 (1) 2. Mathematik Lineare Algebra, Algebra und Elemente der Zahlentheorie				
Module	appea	nrs in			
	Bachelor' degree (1 major) Mathematics (2008)				
Bachelor' degree (1 major) Mathematics (2007)					
	Bachelor' degree (1 major) Economathematics (2009)				
	Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009)				
	-				
		ree (1 major) Computatio gree (1 major, 1 minor) Ma			
1151 310	First state examination for the teaching degree Gymnasium Mathematics (2009)				

Module title					Abbreviation
Seminar in Geometry					10-M-BSG-072-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 semester 🛛 ı		undergraduate			
Contents					
A selected topic in geometry or differential geometry.					
Intended learning outcomes					
The student gains first experience with independent scientific work. He/She masters elaboration and structuring of a given topic using selected literature, and prepares a talk on the subject. He/She is able to participate active- ly in a scientific discussion.					
<b>Courses</b> (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 (approx. 60 minutes)					
Assessment offered: in the semester in which the course is offered Language of assessment: German, English if agreed upon with the examiner					
Allocation of places					
Additional information					
Workload					
Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
§ 73 (1) 4. Mathematik Geometrie					
Module appears in					
Bachelor' degree (1 major) Mathematics (2008)					
Bachelor' degree (1 major) Mathematics (2007)					
Bachelor' degree (1 major) Economathematics (2009)					
Bachelor' degree (1 major) Economathematics (2008)					
Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009)					
Bachelor's degree (1 major, 1 minor) Mathematics (2009)					
		mination for the teaching			

Module	title				Abbreviation
Semina	r in Nu	mber Theory			10-M-BSZ-072-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)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
A selec	ted top	ic in number theory.			
Intende	ed leari	ning outcomes			
of a giv	en topi				sters elaboration and structuring /She is able to participate active-
Course	<b>5</b> (type, n	umber 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	2)
module is	creditab	le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
Assess	ment o	oo minutes) ffered: in the semester in ssessment: German, Eng			
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ıg cycl	8			
		LPO I (examination regulations			
§ 73 (1)	2. Mat	hematik Lineare Algebra,	, Algebra und Elemen	te der Zahlentheorie	
Module					
	-	ree (1 major) Mathematic			
	-	ree (1 major) Mathematic ree (1 major) Economathe			
	-	ree (1 major) Economathe	-		
	-	ree (1 major) Mathematic			
	-	ree (1 major) Computation		9)	
		gree (1 major, 1 minor) Ma			
First sta	ate exa	mination for the teaching	degree Gymnasium	Mathematics (2009)	

Semina				Abbreviation
	r in Ordinary Differential Equat	ions		10-M-BSW-072-m01
Module	coordinator		Module offered by	
Dean of	Studies Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Method of grading	Only after succ. com	pl. of module(s)	
5	numerical grade		-	
Duratio	n Module level	Other prerequisites		
1 semes	ter undergraduate			
Content	S			
A select	ed topic in the theory of ordina	ry differential equation	ons.	
	d learning outcomes	· · ·		
of a give				sters elaboration and structuring /She is able to participate active-
Courses	(type, number of weekly contact hours, l	anguage — if other than Ger	man)	
S (no in	formation on SWS (weekly cont	act hours) and cours	e language available	2)
module is	of assessment (type, scope, langua creditable for bonus) prox. 60 minutes)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
Assessn	nent offered: in the semester ir ge of assessment: German, Eng			
Allocati	on of places			
Addition	nal information			
Workloa	ad			
Teachin	g cycle			
Referred	d to in LPO I (examination regulation	s for teaching-degree progra	mmes)	
§ 73 (1)	1. Mathematik Analysis			
	appears in			
	r' degree (1 major) Mathematic			
	or' degree (1 major) Mathematic			
	or' degree (1 major) Economathe or' degree (1 major) Economathe	-		
	or' degree (1 major) Economatic or' degree (1 major) Mathematic			
	r' degree (1 major) Mathematic		ററ	
	or's degree (1 major, 1 minor) M			
	te examination for the teaching			)

Module	title				Abbreviation
Semina	r in Co	mplex Analysis			10-M-BSC-072-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)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
A selec	ted top	ic in complex analysis.			
Intende	ed leari	ning outcomes			
of a giv	en topi				sters elaboration and structuring /She is able to participate active-
Course	<b>5</b> (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	)
		s <b>essment</b> (type, scope, langua <sub>)</sub> le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
Assess	ment o	50 minutes) ffered: in the semester in ssessment: German, Eng			
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)	
§ 73 (1)	1. Mat	hematik Analysis			
Module	appea	irs in			
Bachel	or' deg	ree (1 major) Mathematic	s (2008)		
	-	ree (1 major) Mathematic			
	-	ree (1 major) Economathe	-		
		ree (1 major) Economathe			
	-	ree (1 major) Mathematic			
	-	ree (1 major) Computation gree (1 major, 1 minor) Ma		•	
		mination for the teaching			

Module	Module title Abbreviation				
Semina	r in Nu	merical Mathematics			10-M-BSN-072-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)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
A selec	ted top	ic in numerical mathema	tics.		
Intende	ed learn	ning outcomes			
of a giv	en topi				sters elaboration and structuring /She is able to participate active-
Course	<b>S</b> (type, n	umber 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	)
module is	creditab	essment (type, scope, langua le for bonus) 50 minutes)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
Assess	ment o	ffered: in the semester in sessment: German, Eng			
Allocat					
Additio	nal info	ormation			
Worklo	ad				
Teachir	ng cycl	9			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
§ 73 (1)	5. Mat	hematik Angewandte Ma	thematik		
Module	appea	rs in			
Bachelo Bachelo Bachelo	Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008)				
Bachelo Bachelo	or' degi or's deg	ree (1 major) Mathematic ree (1 major) Computation gree (1 major, 1 minor) Ma mination for the teaching	nal Mathematics (200 athematics (Minor, 20	008)	

Module	e title				Abbreviation
Semina	ar in St	ochastics			10-M-BSS-072-m01
Module	e coord	inator		Module offered by	<u>.</u>
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts		·		
A selec	ted top	ic in stochastics.			
Intende	ed lear	ning outcomes			
of a giv	en topi				sters elaboration and structuring /She is able to participate active-
Course	<b>S</b> (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)
		<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	ot every semester, information on whether
Assess	ment o	50 minutes) ffered: in the semester ir ssessment: German, Eng			
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
Referre	d to in	LPOI (examination regulation	s for teaching-degree progra	mmes)	
§ 73 (1)	3. Mat	hematik Stochastik	-		
Module	e appea	urs in			
Bachel	or' deg	ree (1 major) Mathematic	s (2008)		
	-	ree (1 major) Mathematic			
	-	ree (1 major) Economathe	-		
	-	ree (1 major) Economathe			
	-	ree (1 major) Mathematic	•		
		ree (1 major) Computatio gree (1 major, 1 minor) M			
		mination for the teaching			
			See Synnasian		,

Module	title				Abbreviation
Semina	r in Fu	nctional Analysis			10-M-BSF-072-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)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
A selec	ted top	oic in functional analysis.			
Intende	ed learı	ning outcomes			
of a giv	en topi	•	•	-	sters elaboration and structuring /She is able to participate active-
Course	<b>S</b> (type, n	number 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	e)
		<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
talk (ap	prox. 6	óo minutes)			
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	e appea	ars in			
Bachelo Bachelo Bachelo Bachelo Bachelo	or' deg or' deg or' deg or' deg or' deg	ree (1 major) Mathematic ree (1 major) Mathematic ree (1 major) Economathe ree (1 major) Economathe ree (1 major) Mathematic ree (1 major) Computatio gree (1 major, 1 minor) Ma	s (2007) ematics (2009) ematics (2008) al Physics (2009) nal Mathematics (200	•	

Module	Module title Abbreviation					
Semina	ar in Op	eration Research			10-M-BSO-072-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
A selec	ted top	ic in operations research	l.			
Intende	ed lear	ning outcomes				
of a giv	en top				sters elaboration and structuring /She is able to participate active-	
Course	<b>S</b> (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)	
		<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk (ap	prox. 6	óo minutes)				
Allocat	ion of <sub>l</sub>	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module	e appea	urs in				
Bachelo Bachelo Bachelo Bachelo Bachelo	Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)					

Module	Module title Abbreviation					
Semina	ar in Di	screte Mathematics			10-M-BSD-072-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
A selec	ted top	oic in discrete mathemation	cs.			
Intende	ed lear	ning outcomes				
of a giv	en top				sters elaboration and structuring /She is able to participate active-	
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	rman)		
S (no ir	format	tion on SWS (weekly cont	act hours) and cours	e language available	2)	
		<b>sessment</b> (type, scope, langua ıle for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk (ap	prox. e	60 minutes)				
Allocat	ion of <sub>l</sub>	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module	e appea	ars in				
Bachel Bachel Bachel Bachel Bachel	Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)					

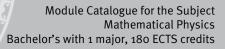
Module	e title				Abbreviation	
Introdu	uction t	o Discrete Mathematics	5		10-M-EDM-072-mo	1
Module	e coord	inator		Module offered by		
Dean o	of Studio	es Mathematik (Mathen	natics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
5		rical grade		•		
Duratio		Module level	Other prerequisites			
1 seme	ester	undergraduate	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	t. Students who mee n the current or in th date, students will h	nts about the respe ion for the course w hission to assessme or admission to asse will put their registra et all prerequisites w e subsequent seme	ctive details ill be con- nt. If stu- ssment over ation for as- rill be admit- ster. For as-
Conten	its					
Techni	ques fro	om combinatorics, intro g codes.	duction to graph theo	ry (including applica	tions), cryptographi	c methods,
Intend	ed lear	ning outcomes				
levant realise	proof te s the so	acquainted with the fu echniques, is able to ap cope of applications of	ply methods from num discrete structures.	ber theory and alge		
	_	umber of weekly contact hours				
Metho	d of ass	mation on SWS (weekly sessment (type, scope, lang le for bonus)	·		-	ion on whether
by an c 2, appr	oral exa rox. 30	nation (approx. 90 minu mination of one candid minutes) ssessment: German, Er	ate each (approx. 20 n	ninutes) or an oral ex		
Allocat			<u> </u>			
Additio	onal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulation	ons for teaching-degree progra	immes)		
		hematik Lineare Algebr			5	
Module	e appea	irs in				
Bachel Bachel	or' deg or' deg	ree (1 major) Computer ree (1 major) Computer ree (1 major) Mathemat ree (1 major) Mathemat	Science (2010) ics (2008)			
		or Mathematical Physics		generated 26-Aug-2024 • ex		

Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Module	e title				Abbreviation		
Introdu	uction t	o Functional Analysis			10-M-FAN-072-mo	1	
Module	e coord	inator		Module offered by	Ι		
Dean o	of Studio	es Mathematik (Mathem	natics)	Institute of Mathem	natics		
ECTS		od of grading	Only after succ. com				
5	1	rical grade					
Duratio		Module level	Other prorequisites				
1 semester       undergraduate       Certain prerequisites must be m sessment. The lecturer will informat the beginning of the course. R sidered a declaration of will to sidents have obtained the qualified the course of the semester, the lisessment into effect. Students w ted to assessment in the current sessment at a later date, student				rer will inform stude he course. Registrat n of will to seek adm I the qualification fo mester, the lecturer Students who mee n the current or in th	nts about the respe- tion for the course we hission to assessme or admission to assess will put their register all prerequisites we e subsequent seme	ective details vill be con- ent. If stu- essment over ration for as- vill be admit- ester. For as-	
Conten	nts		-				
		s and Hilbert spaces, bo	ounded operators, prir	ciples of functional	analysis.		
	-	ning outcomes		•	,		
Course V + Ü (r Methoo module is written by an o 2, appr	es (type, r no infor d of ass s creditab examin oral exa rox. 30	bility of the theory to oth number of weekly contact hours, mation on SWS (weekly sessment (type, scope, langu le for bonus) nation (approx. 90 minu mination of one candida minutes) ssessment: German, En	language — if other than Ger contact hours) and co age — if other than German, o tes); if announced by ate each (approx. 20 n	man) purse language avail examination offered — if no the lecturer, the writ hinutes) or an oral ex	ot every semester, information ca	n be replaced	
			glisti li agreeu upoli w				
Allocal	tion of p	Jlaces	-				
Additio		ormation					
Teachi	ng cycl	e					
		<b>LPO I</b> (examination regulation hematik Analysis	ns for teaching-degree progra	mmes)			
	e appea	•					
Bachel Bachel Bachel Bachel	lor' deg lor' deg lor' deg lor' deg	ree (1 major) Mathemati ree (1 major) Mathemati ree (1 major) Technology ree (1 major) Technology ree (1 major) Economath	cs (2007) / of Functional Materia / of Functional Materia	-			

Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Master's degree (1 major) Technology of Functional Materials (2010) Master's degree (1 major) Technology of Functional Materials (2009) Master's degree (1 major) Functional Materials (2012) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009) Bachelor' degree (1 major) Technology of Functional Materials (2009)

Module	title				Abbreviation	
Operati	ions Re	esearch			10-M-ORS-072-m01	
Module	coord	inator		Module offered by		
Dean of	fStudie	es Mathematik (Mathe	matics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites	i		
1 semes	ster	undergraduate	sessment. The lecture at the beginning of the sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i	s must be met to qua irer will inform stude the course. Registrat on of will to seek adm d the qualification fo mester, the lecturer t. Students who mee n the current or in th date, students will h sment anew.	nts about the respection for the course wints in the course wints on to assessment radmission to assest will put their registrates were subsequent semesticated as the semestic term of term	ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as-
Conten	ts					
Linear p	orograr	nming, duality theory,	transport problems, int	egral linear program	ming, graph theoret	ic problems.
Intende	ed leari	ning outcomes				
for solv	ing ma		undamental methods ir especially in economic merically.			
Courses	<b>S</b> (type, n	umber of weekly contact hour	rs, language — if other than Ger	rman)		
V + Ü (n	no infor	mation on SWS (week	ly contact hours) and co	ourse language avail	able)	
		essment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	on on whether
by an o 2, appro	ral exa ox. 30	mination of one candio minutes)	utes); if announced by date each (approx. 20 n nglish if agreed upon w	ninutes) or an oral ex		
Allocati			·			
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulat	ions for teaching-degree progra	ammes)		
§ 73 (1)	5. Mat	hematik Angewandte I	Mathematik			
Module	e appea	ars in				
Bachelo Bachelo Bachelo Bachelo	or' deg or' deg or' deg or' deg or' deg	ree (1 major) Computer ree (1 major) Computer ree (1 major) Mathema ree (1 major) Mathema ree (1 major) Economa or Mathematical Physics	Science (2010) tics (2008) tics (2007) thematics (2009)	generated 26-Aug-2024 • ex.	am reg da-	page 49 / 156
(2009)			-	r (180 ECTS) Mathematische I	-	F-0-47/10



Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Non-Linear Dynamics       Module offered by         Dean of Studies Mathematik (Mathematics)       Institute of Mathematics         CTS       Method of grading       Only after succ. compl. of module(s)         s numerical grade       -         Duration       Module level       Other 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 over the course of the semester. The lecturer will put their registration for admission to assessment into effect. Students who meet all prerequisites will be admission to assessment over the course of the semester. If studies who meet all prerequisites will be admission to assessment into effect. Students who neet all precequisites will be admission to assessment into effect. Students who meet all precequisites will be admission to assessment into effect. Students who meet all precequisites will be admission to assessment into effect. Students who but an the qualification for admission to assessment into effect. Students who but all have to obtain the qualification for admission to assessment into effect. Students who admission to assessment over the course of the semester, the acture will have to obtain the qualification for admission to assessment. The lecture will have to obtain the qualification for admission to assessment. The secure advises who advises admission to assessment in the furch admission to assessment. The secure advises who advises admission to assessment and advise tade. Students who advises admission to assessment advise tade. Students who advises admission to assessment in the furch secure advises who advise admisited with the fundamental concepts and test.	Module	e title				Abbreviation	
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 semester         undergraduate         Certain prerequisites must be met to qualify for admission to assessment. The lecturer will not the course will be considered a declaration of will to seek admission to assessment over the course of the course. Registration for the course set of the course. Registration for the course will be admitted to qualify for admission to assessment over the course of the semester, the lecturer will put their registration for assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment in the current or in the subsequent semester. For assessment in student is acquainted with the fundamental concepts and results in non-linear dynamics and their proof me thods. He/She is able to apply these methods to simple situations, e.g. in physics or biology.           Courses (type, number of weekly contact hours, language – if other than German)         V + () to information on SWS (weekly contact hours) and course language available)           Method of assessment (type, scope, language – if other than German)         V + () to information on SWS (weekly contact hours, anduage – if other than German)	Non-Liı	near Dy	namics			10-M-NLD-072-m01	
Dean of Studies Mathematik (Mathematics)       Institute of Mathematics         ECTS       Method of grading       Only after succ. compl. of module(s)         5       numerical grade          1 semester       Module level       Other prerequisites         1 semester       undergraduate       Certain prerequisites must be met to qualify for admission to assessment over the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment over the course of the semester, the lecturer will put their registration for admission to assessment over the course of the semester, the lecturer will put their registration for admission to assessment over the course of the semester, the lecturer will put their registration for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment and the course of the semester. For assessment in the furce date is subcating Poincare-Bendixson, chaotic dynamics; applications in physics and biology (e. g. Hamiltonian systems, Volterra-Lotka).         Intended learning outcomes       The student is acquainted with the fundamental concepts and results in non-linear dynamics and their proof methods. He/5 he is able to apply these methods to simple situations, e.g. in physics or biology.         Courses type, number of weeky contact hours, language – if other than German, examination of methods he/5 he/5 he/s able to apply these methods to simple situations.       The student is acquainted with the fundamental concepts and results in non-linear dynamics and their proof methods. He/5 he/s able to apply these methods to simple situations, e.g. in physics or biology.	Module	e coord	inator		Module offered by		
ECTS       Method of grading       Only after succ. compl. of module(s)         5       numerical grade	Dean o	f Studie	es Mathematik (Mathem	atics)		natics	
5       numerical grade          Duration       Module level       Other prerequisites         1 semester       undergraduate       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 over the course of the semester, the lecturer will put their registration for assessment in the fere. Students who meet all prerequisites will be admitted to assessment in the fere. Students who meet all prerequisites will be admitted to assessment in the fere. Students who meet all prerequisites will be admitted to assessment and are date, students will have to obtain the qualification for admission to assessment and are date, students will have to obtain the qualification for admission to assessment and are date, students will have to obtain the qualification for admission to assessment. The student is acquainted with the fundamental concepts and results in non-linear dynamics and their proof me thods. He/She is able to apply these methods to simple situations, e.g. in physics or biology.         Courses (pre, number of weekly contact hours, language – if other than Geman)       V + Û (no information on SWS (weekly contact hours) and course language available)         Methods He/She is able to apply these methods to simple situations, e.g. in physics or biology.       Courses (pre, number of weekly contact hours) and course language available)         Methods is for bands       Germanination of SWS (weekly contact hours) and course language available)         Methods is for bands       Germanination of one candidate each (approx. 20 m	_	1	· · · · ·	E .			
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Referred to in LPO I (examination regulations for teaching-degree programmes)         § 73 (1) 1. Mathematik Analysis         Module appears in         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Mathematics (2007)         Bachelor' degree (1 major) Economathematics (2009)         Bachelor' degree (1 major) Economathematics (2008)         Bachelor' degree (1 major) Mathematics (2009)	WORKIO	Dad					
Referred to in LPO I (examination regulations for teaching-degree programmes)         § 73 (1) 1. Mathematik Analysis         Module appears in         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Mathematics (2007)         Bachelor' degree (1 major) Economathematics (2009)         Bachelor' degree (1 major) Economathematics (2008)         Bachelor' degree (1 major) Mathematics (2009)	Teachi		0				
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§ 73 (1) 1. Mathematik Analysis          Module appears in         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Mathematics (2007)         Bachelor' degree (1 major) Economathematics (2009)         Bachelor' degree (1 major) Economathematics (2008)         Bachelor' degree (1 major) Mathematics (2009)	Referre	ed to in	LPO I (examination regulation	ns for teaching-degree progra	mmes)		
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(2009) ta record Bachelor (180 ECTS) Mathematische Physik - 2009	Bachelor's			JMU Würzburg •			ge 51 / 156

Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2011) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Module	e title				Abbreviation	
Introdu	iction t	o Geometry		10-M-GEO-082-m01		
Module	e coord	inator		Module offered by		
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathem	natics	
ECTS	Methe	od of grading	Only after succ. compl. of module(s)			
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 semester un		undergraduate	By way of exception, additional prerequisites are listed in the section assessments.		isites are listed in the section on	
Conten	ts	~	• •			

Introduction to topics in geometry: axiomatic introduction of projective spaces, coordinates, fundamental theorems, relations to linear algebra and algebra, curves and hypersurfaces in Euclidean spaces, curvature.

## Intended learning outcomes

The student is acquainted with the fundamental concepts and methods of geometry.

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

This module has 2 components; information on courses listed separately for each component.

- 10-M-GEO-1-082: V + Ü (no information on language and number of weekly contact hours available)
- 10-M-GEO-2-082: V + Ü (no information on language and number of weekly contact hours available)

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

This module has the following 2 assessment components. To pass the module as a whole students must pass one of the two assessment components.

# Assessment component to module component 10-M-GEO-1-082: Einführung in die Projektive Geometrie

- 8 ECTS credits, method of grading: numerical grade
- written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)
- Language of assessment: English, German if agreed upon with the examiner
- Other prerequisites: Admission prerequisite to assessment: successful completion of approx. 50% of exercises. Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment component to module component 10-M-GEO-2-082: Einführung in die Differentialgeometrie

- 8 ECTS credits, method of grading: numerical grade
- written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)
- Language of assessment: English, German if agreed upon with the examiner
- Other prerequisites: Admission prerequisite to assessment: successful completion of approx. 50% of exercises. Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

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## Allocation of places

## Additional information

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# Workload

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# Teaching cycle

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

§ 73 (1) 4. Mathematik Geometrie

# Module appears in

Bachelor' degree (1 major) Mathematics (2008)

Bachelor' degree (1 major) Economathematics (2009)

Bachelor' degree (1 major) Economathematics (2008)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Computational Mathematics (2009)

Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)

First state examination for the teaching degree Gymnasium Mathematics (2009)

Module	e title				Abbreviation
Numbe	r Theo	ry and Algebra			10-M-ZAL-082-m01
Module	e coord	inator		Module offered by	
Dean of Studies Mathematik (Mathematics)		atics)	Institute of Mathem	natics	
ECTS	Methe	od of grading	Only after succ. con	npl. of module(s)	
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
5		By way of exception, additional prerequisites are listed in the section on assessments.			
Conten	tc				

Introduction to number theory, algebra and their interrelations: basic algebraic structures (groups, rings, fields); discussion of properties of integers and rational numbers (as well as algebraic extensions) with regard to their algebraic structure (residue class rings and finite fields).

# Intended learning outcomes

The student is acquainted with the fundamental concepts and methods of number theory and algebra. He/she is able to interrelate these concepts and realises the advantages of thinking across the borders of different branches in mathematics.

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

This module comprises 3 module components. Information on courses will be listed separately for each module component.

- 10-M-ZAL-1-082: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 10-M-ZAL-2-082: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 10-M-ZAL-P-082: M (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)

Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

Assessment in module component 10-M-ZAL-1-082: Introduction to Number Theory Introduction to Number Theory

- 4 ECTS, Method of grading: (not) successfully completed
- written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)
- Language of assessment: German, English if agreed upon with the examiner
- Other prerequisites: Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-ZAL-2-082: Introduction to Algebra Introduction to Algebra

- 7 ECTS, Method of grading: (not) successfully completed
- written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)
- Language of assessment: German, English if agreed upon with the examiner
- Other prerequisites: Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for

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(2009)	ta record Bachelor (180 ECTS) Mathematische Physik - 2009	

the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-ZAL-P-082: Examination in Number Theory and Algebra

- 2 ECTS, Method of grading: numerical grade
- oral examination of one candidate each (approx. 30 minutes)
- Language of assessment: German, English if agreed upon with the examiner
- Only after successful completion of module components: Successful completion of module component 10-M-ZAL-1 or module component 10-M-ZAL-2 is a prerequisite for participation in module component 10-M-ZAL-P.

**Allocation of places** 

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## Additional information

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Workload

Teaching cycle

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

§ 73 (1) 2. Mathematik Lineare Algebra, Algebra und Elemente der Zahlentheorie

## Module appears in

Bachelor' degree (1 major) Mathematics (2008)

Bachelor' degree (1 major) Economathematics (2009)

Bachelor' degree (1 major) Economathematics (2008)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Computational Mathematics (2009)

Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)

First state examination for the teaching degree Gymnasium Mathematics (2009)

Module	e title				Abbreviation	
Numerical Mathematics 1					10-M-NM1-082-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studie	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS		od of grading	Only after succ. con			
	1					
8 Duratio		rical grade Module level	 Other preveruisites			
			Other prerequisites			
1 semester 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 anew.			ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as-	
Conten	ts					
Solutio	n of sys	stems of linear equation tion with polynomials, s				s of equati-
Intend	ed learı	ning outcomes				
		acquainted with the fur oblems and knows abou			erical mathematics,	applies them
Course	<b>S</b> (type, n	umber of weekly contact hours,	language — if other than Ger	man)		
V + Ü (I	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
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		le for bonus)			,	
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Teachi	ig cycl	9				
		LPOI (examination regulation		mmes)		
		hematik Angewandte M	athematik			
	e appea					
	-	ree (1 major) Computer S				
	-	ree (1 major) Mathemati ree (1 major) Physics (20				
	-	ree (1 major) Physics (20				
	-	ree (1 major) Physics (20	•			
	-	or Mathematical Physics		generated 26-Aug-2024 • ex	am, reg. da-	page 57 / 156

# UNIVERSITÄT WÜRZBURG

Bachelor' degree (1 major) Physics (2008) Bachelor' degree (1 major) Technology of Functional Materials (2009) Bachelor' degree (1 major) Technology of Functional Materials (2010) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Technology of Functional Materials (2010) Master's degree (1 major) Technology of Functional Materials (2009) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Functional Materials (2012) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Module	e title				Abbreviation	
Stochastics 1				10-M-ST1-082-m01		
Module coordinator			Module offered by			
		es Mathematik (Mathe	matics)	Institute of Mathem	natics	
ECTS	1	od of grading	Only after succ. con	pl. of module(s)		
8		rical grade				
Duratio		Module level	Other prerequisites			
1 semester undergraduate		sessment. The lecture at the beginning of the sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment into	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					
continu chastic varianc	ious di indepe e, limit	stributions: normal dis endence, elementary co theorems: law of large	ected discrete distributi tribution, random varia onditional probability, o e numbers, central limit	ble, distribution fun characteristics of dis	ction, product meas	ures and sto-
Intende	ed lear	ning outcomes				
			amental concepts and r the typical fields of ap		ics, applies these m	ethods to
			s, language — if other than Ger			
		· · · · · ·	ly contact hours) and co		· · · · · · · · · · · · · · · · · · ·	
		s <b>essment</b> (type, scope, lang le for bonus)	guage — if other than German, o	examination offered — if no	ot every semester, informat	on on whether
by an o 2, appr	oral exa ox. 30	mination of one candio minutes)	utes); if announced by date each (approx. 20 n nglish if agreed upon w	ninutes) or an oral ex		
Allocat	<u> </u>		<u></u>			
Additio	nal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	mmes)		
§ 73 (1)	3. Mat	hematik Stochastik				
Module						
Bachel	or' deg	ree (1 major) Computer ree (1 major) Mathema ree (1 major) Economat	tics (2008)			
Bachelor's (2009)	with 1 maj	or Mathematical Physics	JMU Würzburg • ta record Bachelo	generated 26-Aug-2024 • ex	am. reg. da-	page 59 / 156

Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Module	e title				Abbreviation	
Numerical Mathematics 2					10-M-NM2-082-mo	1
Module	e coord	inator		Module offered by	1	
Dean o	of Studio	es Mathematik (Mathem	natics)	Institute of Mathem	natics	
ECTS		od of grading	Only after succ. com			
5	1	rical grade		, , , ,		
Duratio		Module level	Other prerequisites			
1 semester 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 anew.				
Conten	nts					
Solutio nary di	on meth ifferenti	ods and applications fo al equations, boundary		s, linear programmin	ng, initial value prob	lems for ordi-
		ning outcomes				
about t	their ad	able to draw a distincti vantages and limitation ng sciences and econon	s concerning the poss			
Course	<b>es</b> (type, r	number of weekly contact hours,	language — if other than Ger	man)		
V + Ü (I	no infoi	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		<b>sessment</b> (type, scope, langu le for bonus)	age — if other than German, e	examination offered — if no	ot every semester, informat	ion on whether
by an o 2, appr	oral exa rox. 30	nation (approx. 90 minu mination of one candida minutes) ssessment: German, En	ate each (approx. 20 n	ninutes) or an oral ex		•
	tion of p					
Additic	onal inf	ormation				
Worklo	bad					
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulation	ns for teaching-degree progra	mmes)		
		hematik Angewandte M				
	e appea					
Bachel Bachel Bachel	lor' deg lor' deg lor' deg	ree (1 major) Mathemati ree (1 major) Physics (20 ree (1 major) Physics (20 ree (1 major) Physics (20	010) 009)			
	with 1 ma	jor Mathematical Physics	IMIL Würzburg	generated 26-Aug-2024 • ex		page 61 / 156

# UNIVERSITÄT WÜRZBURG

Bachelor' degree (1 major) Physics (2008) Bachelor' degree (1 major) Technology of Functional Materials (2009) Bachelor' degree (1 major) Technology of Functional Materials (2010) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Technology of Functional Materials (2010) Master's degree (1 major) Technology of Functional Materials (2009) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Functional Materials (2012) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Modul	e title				Abbreviation	
Stochastics 2					10-M-ST2-082-m01	
Modul	e coord	inator		Module offered by		
Dean c	of Studie	es Mathematik (Mathe	matics)	Institute of Mathem	atics	
ECTS	1	od of grading	Only after succ. com			
5	· · · · ·	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester undergraduate		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	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			
Conter	nts					
		ata analysis, statistics	of data in normal and o	ther distributions	lements of multivari	ate statistics
		ning outcomes				
		•				
			amental concepts and r typical fields of applica		, applies these metr	loas to prac-
			s, language — if other than Ger			
			y contact hours) and co		abla)	
		essment (type, scope, lang le for bonus)	guage — if other than German, e	examination offered — if no	t every semester, informati	ion on whether
			utes); if announced by	the lecturer the writ	ten examination car	he replaced
			late each (approx. 20 n			
		minutes)		·		
Langua	age of a	ssessment: German, E	nglish if agreed upon w	ith the examiner		
Allocat	tion of p	olaces				
Additio	onal info	ormation				
Worklo	ad					
Teachi	ng cycl	2				
Teacill	ng cycl					
			ons for teaching-degree progra	mmes)		
§ 73 (1	) 3. Mat	hematik Stochastik				
		rc in				
	e appea					
Bachel	or' deg	ree (1 major) Mathema				
Bachel Bachel	or' degi or' degi	ree (1 major) Mathema ree (1 major) Economa	thematics (2009)			
Bachel Bachel Bachel	or' degi or' degi or' degi	ree (1 major) Mathema ree (1 major) Economa ree (1 major) Economa	thematics (2009) thematics (2008)			
Bachel Bachel Bachel Bachel	or' degi or' degi or' degi or' degi	ree (1 major) Mathema ree (1 major) Economa ree (1 major) Economa ree (1 major) Mathema	thematics (2009) thematics (2008) tical Physics (2009)	20)		
Bachel Bachel Bachel Bachel Bachel	or' degi or' degi or' degi or' degi or' degi	ree (1 major) Mathema ree (1 major) Economa ree (1 major) Economa ree (1 major) Mathema ree (1 major) Computat	thematics (2009) thematics (2008) tical Physics (2009) tional Mathematics (200	-		
Bachel Bachel Bachel Bachel Bachel Bachel	or' degi or' degi or' degi or' degi or' degi or's degi	ree (1 major) Mathema ree (1 major) Economa ree (1 major) Economa ree (1 major) Mathema ree (1 major) Computat	thematics (2009) thematics (2008) tical Physics (2009) tional Mathematics (200 Mathematics (Minor, 20	-	am. reg. da-	page 63 / 156



First state examination for the teaching degree Gymnasium Mathematics (2009)

Modul	e title				Abbreviation	
Advanced Analysis					10-M-VAN-082-m01	
Module coordinator				Module offered by		
Dean o	of Studi	es Mathematik (Mathe	matics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
8		rical grade				
Duratio		Module level	Other prerequisites			
1 semester undergraduate		sessment. The lecture at the beginning of the sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later	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.			
Conter	nts					
Lebesg	gue inte	gral in several variable ry Fourier theory in L^2	s, including theorems o , Gauss's theorem.	on convergence and	Fubini's theorem, L^	p-spaces
Intend	ed lear	ning outcomes				
			nced topics in analysis uction of a complex ma		e of the Lesbegue inte	egral, he or
Course	<b>es</b> (type, r	number of weekly contact hour	s, language — if other than Ger	man)		
Ü + V (	no infoi	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
		<b>Sessment</b> (type, scope, lang le for bonus)	guage — if other than German, o	examination offered — if no	ot every semester, information	on on whether
by an o 2, appi	oral exa rox. 30	mination of one candic minutes)	utes); if announced by date each (approx. 20 n nglish if agreed upon w	ninutes) or an oral ex		
Allocat	tion of p	olaces				
Additio	onal inf	ormation				
Worklo	bad					
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	mmes)		
		hematik Analysis	0 - 30.22 P. 00.00			
	e appea					
Bachel Bachel Bachel	lor' deg lor' deg lor' deg	ree (1 major) Mathema ree (1 major) Economat ree (1 major) Economat ree (1 major) Mathema	thematics (2009) thematics (2008)			
	lar' dag	ree (1 major) Computat	in al Mathematica (an	<b>`</b>		
Bachel	ior deg	iee (1 majoi) computat	ional Mathematics (20)	09)		

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) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Module title Abbreviation							
Model	Modelling and Computational Science10-M-MWR-092-m01						
Modul	e coord	inator		Module offered by			
Dean c	of Studio	es Mathematik (Mathema	atics)	Institute of Mathem	natics		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
8	nume	rical grade					
Durati	on	Module level	Other prerequisites				
1 seme	ester	undergraduate					
Conter	nts						
scaling ons, fu	g the mo	odelling, asymptotic serie ntal methods for numeric	es, classical methods	for solving ordinary	rinciples of modelling, aspects of and partial differential equati- ns and the resulting systems of li-		
Intend	ed lear	ning outcomes					
		asters the fundamental r ng sciences on a comput		ds and techniques to	simulate processes from natural		
Course	<b>S</b> (type, r	umber of weekly contact hours, l	anguage — if other than Ger	rman)			
V + Ü (	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)		
		<b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	ot every semester, information on whether		
		mination (approx. 90 min tes) or c) oral examinatio			tion of one candidate each (ap- utes)		
-	tion of p		0 1 0 1	· 11 5			
Additio	onal inf	ormation					
Worklo	ad						
Teachi	ng cycl	е					
Referre	ed to in	LPO I (examination regulation	s for teaching-degree progra	immes)			
Modul	e appea	ars in					
	-	ree (1 major) Nanostructu		)			
		ree (1 major) Mathematic		,			
Bache	or' deg	ree (1 major) Computatio	nal Mathematics (20	09)			

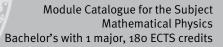


# **Physics** (ECTS credits)

Students who took module 11-QAM or module 11-FKP will not be able to take module 11-KM. With regard to future participation in the Master's degree programme FOKUS Physik (Physics), students interested in participating in the FOKUS programme are recommended to take modules 11-KM and 11-KET.

Module title Abbreviation							
Astroph	hysics				11-A4-072-m01		
Module coordinator				Module offered by	1		
	ing Dire	ector of the Institute of	Theoretical Physics	Faculty of Physics a	and Astronomy		
ECTS		od of grading	Only after succ. con	npl. of module(s)			
6		rical grade					
Duratio	<u> </u>	Module level	Other prerequisites				
1 seme	ster	undergraduate	50% of exercises. C sion to assessment ve details at the beg be considered a dec students have obtain over the course of the assessment into eff mitted to assessme	on prerequisite to assessment: successful completion of approx. exercises. Certain prerequisites must be met to qualify for admis- ssessment. The lecturer will inform students about the respecti- s at the beginning of the course. Registration for the course will dered a declaration of will to seek admission to assessment. If have obtained the qualification for admission to assessment course of the semester, the lecturer will put their registration for the transfer of the course admission to assessment course of the semester, the lecturer will put their registration for the time of the current or in the subsequent semester. For the tat a later date, students will have to obtain the qualification			
Conten				sessment anew.			
large-so nucleos <b>Intende</b> The stu physica	cale str synthes ed learn idents a al obse iey know	n, structure of the Milky ucture of the universe, sis, cosmic microwave l <b>ning outcomes</b> are familiar with the mo rvations and evaluatior w the structure of the u	Friedmann World Mod background radiation, odern world view of Ast ns. They are able to use	els, thermodynamics structure formation, rophysics. They know these methods to p	s of the early univers inflation w methods and tool olan and analyse ow	se, primordial s for astro- n observati-	
•		umber of weekly contact hours	. language — if other than Ge	rman)			
		mation on SWS (weekly			able)		
Method	d of ass	essment (type, scope, lang le for bonus)	·			tion on whether	
		nation (approx. 120 mir	nutes)				
Allocat							
		f pool of general key sk	ills (ASQ): 15 places. P	laces will be allocate	ed by lot.		
Additio	nal info	ormation					
 Worklo	ad						
Teachir	ng cycl	9					
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	immes)			
Module							
Bachelo	or' deg	ree (1 major) Physics (2	007)				
Bachelor's ( (2009)	with 1 maj	or Mathematical Physics	-	generated 26-Aug-2024 • ex r (180 ECTS) Mathematische	-	page 69 / 156	





Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2009) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Physics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (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) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2008) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module	e title				Abbreviation
Introdu	iction t	o Plasmaphysics			11-EPP-092-m01
Module	e coord	inator		Module offered by	<u> </u>
Manag and As		ector of the Institute of T sics	heoretical Physics	Faculty of Physics a	and Astronomy
ECTS		od of grading	Only after succ. con	pl. of module(s)	
6	1	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 de at the beginning of the course. Registration for the course will be co sidered a declaration of will to seek admission to assessment. If stu dents have obtained the qualification for admission to assessment the course of the semester, the lecturer will put their registration fo sessment into effect. Students who meet all prerequisites will be ac ted to assessment in the current or in the subsequent semester. Fo sessment at a later date, students will have to obtain the qualificat admission to assessment anew.			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-
Conten	ts				
Transpo thin the	ort equ e solar	ations for energetic part	icles, Properties of ma on via shock waves ar	agnetic turbulence, F nd via interaction wit	elds, Magnetohydrodynamics, Propagation of solar particles wi- th plasma turbulence, Particle ac liation.
Intend	ed lear	ning outcomes			
					of transport phenomena in plas- nowledge to Astrophysics.
Course	<b>S</b> (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)
		<b>Sessment</b> (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	ot every semester, information on whether
groups project (approz Assess and wil examin	(appro report x. 30 m ment o Il be an nation r	x. 30 minutes per candi (approx. 8 to 10 pages, inutes) ffered: When and how o	date, for modules with time to complete: 1 to ften assessment will h der observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o	date each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and
Allocat	ion of p	olaces	<u> </u>		
Additio	nal inf	ormation			
Worklo	ad				
 Teachi	ng cycl	e			
 Doforro	d to in		no fortoookin - Ja		
		LPOI (examination regulatio	is for teaching-degree progra	innines)	
Bachelor's	with 1 ma	jor Mathematical Physics	JMU Würzburg •	generated 26-Aug-2024 • ex	am. reg. da- page 71 / 156
(2009)				r (180 ECTS) Mathematische	

# Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Modul	e title				Abbreviation
Quantum Mechanics II					11-QM2-092-m01
Module coordinator				Module offered by	<u>l</u>
	ing Dire	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	and Astronomy
ECTS Method of grading Only after succ. compl. of module(s)					
8	1	rical grade			
Duration Module level Other prerequisites					
1 semester		undergraduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective deta 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 of the course of the semester, the lecturer will put their registration for sessment into effect. Students who meet all prerequisites will be adr ted to assessment in the current or in the subsequent semester. For sessment at a later date, students will have to obtain the qualification		
Conter	nts	I	admission to asses		
2. Band 3. Angu 4. Scat 5. Rela of aton 6. Qua 7. Cand Intende	d struct ular mo ttering t tivistic nic spe ntum e onical f ed lear udents	quantum mechanics: ctra ntanglement ormalism <b>ning outcomes</b> acquire in-depth know	rystal perators, Lie Algebras ering, partial wave expa Klein-Gordon equation, ledge of advanced qua	Dirac equation, Lore	etz group, fine structure splitting
of the modern thods a	mathen n theor and to i	natical and theoretical etical Quantum Physic nterpret the results ph	concepts of the listed t s mathematically, to so sysically. The course is p	opics. They are able lve problems analyti pivotal to subsequen	to describe or model problems o cally, to use approximation me- it theory courses in Astrophysics, nandatory for all Master's stu-
Course	<b>es</b> (type, r	number of weekly contact hou	rs, language — if other than Ge	rman)	
$R \perp V h$	no infoi	mation on SWS (week	ly contact hours) and co	ourse language avail	able)
л <del>т</del> v (I					
Metho		<b>sessment</b> (type, scope, lan ble for bonus)	guage — if other than German,	examination offered — if no	ot every semester, information on whether
Metho module is a) writt groups project (appro. Assess and wi examir	s creditat ten exa 5 (appro t report x. 30 m sment o Il be an nation r	nle for bonus) mination (approx. 90 r ox. 30 minutes per can (approx. 8 to 10 pages inutes) ffered: When and how	ninutes) or b) oral exam didate, for modules wit s, time to complete: 1 to often assessment will under observance of Se	nination of one candi h less than 4 ECTS cr 9 4 weeks) or d) prese be offered depends o	ot every semester, information on whether idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and

Allocation of places
Additional information
Workload
Teaching cycle
<b>Referred to in LPO I</b> (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)

Bachelor's with 1 major Mathematical Physics

(2009)

Managing Director of the Institute of Theoretical Physics         Faculty of Physics and Astronomy           ECTS         Method of grading         Only after succ. compl. of module(s)           8         numerical grade            Duration         Module level         Other 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 admission to assessment. The locturer will inform students about the respective details at the beginning of the course. Registration for admission to assessment over the course of the semester, the lecturer will put their registration for assessment inte circle of the semester. The admission to assessment or admission to assessment inte circle of the samester in the current or in the subsequent semester. For assessment in the current or in the subsequent semester. For assessment into diffect. Students will have to obtain the qualification for admission to assessment anew.           Contents           This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions.           1 Single-particle Green's function           2 Neview of second quantization           3 Diagrammatic method using many particle Green's functions at temperature T=o           4 Diagrammatic method using many particle Green's functions at temperature T=o           4 Diagrammatic method using many particle Green's function a temperature T=o           9 Londau theory of Fermi liquids           6 Superconductivity	Module	e title				Abbreviation
Managing Director of the Institute of Theoretical Physics         Faculty of Physics and Astronomy           ECTS         Method of grading         Only after succ. compl. of module(s)           8         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 the course of the semester, the lecturer will put their registration for assessment in the current or in the subsequent semester. For assessment in the feat. Students will have to obtain the qualification for admission to assessment anew.           Contents	Many B	Body Qı	uantum Theory			11-QVTP-092-m01
and Astrophysics       Method of grading       Only after succ. compl. of module(s)         8       numerical grade          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 over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.         Contents       This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions. An outline could be:         1 Single-particle Green's function       2 Review of second quantization         3 Diagrammatic method using many particle Green's functions at temperature T=o       4 Diagrammatic method using many particle Green's functions at temperature T=o         4 Diagrammatic method versing outcomes       The students have mastered the principles of quantum field theory in many-particle systems. They are able to apply the acquired methods to current problems of Theoretical Solid-State Physics.         Courses (type, number of weekly contact hours, language – if other than German)       R + V (no information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than German)       A writte	Module coordinator				Module offered by	1
8         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 the course of the semester, the lecturer will put their registration for assessment time offect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment in the diffect. Students who meet all prerequisites will be admitted to assessment at a later date, students will have to obtain the qualification for admission to assessment anew.           Contents           This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions. An outline could be:           1 Single-particle Green's function           2 Review of second quantization           3 Diagrammatic method using many particle Green's functions at temperature T=o           4 Diagrammatic method using many particle Green's functions at temperature T=o           4 Diagrammatic method using many particle Green's function           2 Kewident Method using many particle Green's functions at temperature T=o           4 Diagrammatic method using many particle for the functions at temperature T=o           9 Loigrammatic method using many particle for the funceman				neoretical Physics	Faculty of Physics a	and Astronomy
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 the course of the semester, the lecturer will put their registration for assessment into current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment and aution admission to assessment anew.           Contents         This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions.           A notifice Could be:         1 Single-particle Green's functions at temperature T=0           4 Diagrammatic method using many particle Green's functions at temperature T=0           4 Diagrammatic method using many particle Green's functions at temperature T=0           9 Landau theory of Fermi liquids           6 Superconductivity         7 One-dimensional systems and bosonization           Intended learning outcomes         The students have mastered the principles of quantum	ECTS	ECTS Method of grading Only after succ. compl. of module(s)				
1 semester       graduate       Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment in the current or in the subsequent semester. For asferen's functions.         Contents       This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions.         1 Single-particle Green's function       2 Review of second quantization         3 Diagrammatic method for finite T       5 Jandau theory of Fermi liquids         6 Superconductivity       7 One-dimensional systems and bosonization         Intended learning outcomes       The students whor meety in many-particle systems. They are able to apply the acquired methods to current problems of Theoretical Solid-State Physics.         Courses (type, number of weekly contact hours) and course language available)         Method of assessment (uppc. scope, language – if other than German)         R + V (no information on SWS (weekly contact hours) and course language available)         Method of assessment (uppc. scope, language – if other than German)         R + V (no information (approx. 90 minutes) or b) oral examination of one candidate each or oral ex	8	nume	rical grade			
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.         Contents         This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions. A no uttine could be:         1 Single-particle Green's function 2 Review of second quantization 3 Diagrammatic method of finite T 4 Diagrammatic method for finite T 5 Landau theory of Fermi liquids 6 Superconductivity 7 One-dimensional systems and bosonization         Intended learning outcomes         The students have mastered the principles of quantum field theory in many-particle systems. They are able to ap ply the acquired methods to current problems of Theoretical Solid-State Physics.         Courses (type, number of weekly contact hours,) and course language available)         Method of assessment (type, scope, language – if other than Geman, Reamination 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 (approx. 90 minutes) or co) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 9 minutes) <td>Duratio</td> <td>on</td> <td>Module level</td> <td>Other prerequisites</td> <td></td> <td></td>	Duratio	on	Module level	Other prerequisites		
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This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions. An outline could be: 1 Single-particle Green's function 2 Review of second quantization 3 Diagrammatic method using many particle Green's functions at temperature T=0 4 Diagrammatic method for finite T 5 Landau theory of Fermi liquids 6 Superconductivity 7 One-dimensional systems and bosonization Intended learning outcomes The students have mastered the principles of quantum field theory in many-particle systems. They are able to ap ply the acquired methods to current problems of Theoretical Solid-State Physics. Courses (type, number of weekly contact hours, language – if other than German) R + V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) a) written examination (approx. 90 minutes) or b) or al 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 	Conton					
Courses (type, number of weekly contact hours, language — if other than German) R + V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module 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 Allocation of places	2 Revie 3 Diagr 4 Diagr 5 Landa 6 Supe 7 One-c Intende	ew of se rammat rammat au theo rcondu dimens ed learn idents l	econd quantization ic method using many pa ic method for finite T ory of Fermi liquids ctivity ional systems and bosor <b>ning outcomes</b> have mastered the princi	nization ples of quantum field	l theory in many-par	ticle systems. They are able to ap-
R + V (no information on SWS (weekly contact hours) and course language available) <b>Method of assessment</b> (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 <b>Allocation of places</b>			· · ·	-	· · · ·	5.
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 Allocation of places						-11-)
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English Allocation of places			·	-		
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	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					
 Additional information 			-			
Additional information						
	<u>Additio</u>	onal inf	ormation			

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### Workload

Teaching cycle

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

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## Module appears in

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	e title				Abbreviation
Relativ	istic Ef	fects in Mesoscopic Sy	/stems		11-RMS-092-m01
Module coordinator				Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics			Theoretical Physics	Faculty of Physics a	and Astronomy
ECTS	<u> </u>	od of grading	Only after succ. con	npl. of module(s)	
5 numerical grade					
Duratio	on	Module level	Other prerequisites		
1 semester gradua		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	its	·			
		fects in mesoscopic sy tors Majorana fermio		oling Dirac equatio	n Quantum Hall effect Topo-
Intende	ed lear	ning outcomes			
					elativistic quantum systems, edge to simple systems.
Course	<b>S</b> (type, r	number of weekly contact hou	rs, language — if other than Ge	rman)	
R + V (r	no infoi	rmation on SWS (week	y contact hours) and co	ourse language avail	able)
		<b>Sessment</b> (type, scope, lang ble for bonus)	guage — if other than German,	examination offered — if no	ot every semester, information on whether
groups project (approx Assess and wil examin Langua	(appro report x. 30 m ment o Il be an nation r age of a	ox. 30 minutes per cana (approx. 8 to 10 pages inutes) Iffered: When and how nounced in due form u regulations) 2009.	didate, for modules with , time to complete: 1 to often assessment will l inder observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and
Allocat	ion of <sub>l</sub>	places			
Additio	onal inf	ormation			
 World -					
Worklo	au				
Teachi	ng cvcl	e			
	0 - 9 - 0				
Referre	ed to in	LPO I (examination regulat	ions for teaching-degree progra	ummes)	
Module	e appea	ars in			
Bachelor's (2009)	with 1 ma	jor Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische	

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	
Theoret	tical So	lid State Physics			11-TFK-092-m01	
Module	coord	inator		Module offered by		
Managing Director of the Institute of Theoretica and Astrophysics			Theoretical 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	n	Module level	Other prerequisites			
1 semester		graduate	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	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			
		heoretical Solid-State F tism. Superconductivity	,	eory. Electron-electro	on interaction. Varia	tional me-
Intende	ed learr	ning outcomes				
respond theory a	ding mand to	nave basic knowledge of athematical or theoretion understand the connection opic of solid-state theo	cal methods and are al tions to experimental r	ole to apply them to results. The individua	basic problems of so al students have elal	olid-state
Courses	<b>5</b> (type, n	umber of weekly contact hours	s, language — if other than Ger	man)		
R + V (n	o infor	mation on SWS (weekly	/ contact hours) and co	ourse language availa	able)	
		s <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German, e	examination offered — if no	t every semester, informati	on on whether
groups project (approx Assessi and will examin	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				
Additio	nal inf	ormation				
Workload						
Teachin	Teaching cycle					
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)		
Bachelor's v (2009)	witri 1 maj	or Mathematical Physics	_	generated 26-Aug-2024 • exa r (180 ECTS) Mathematische F	-	page 79 / 156

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)

Bachelor's with 1 major Mathematical Physics

(2009)

Modul	Module title Abbreviation				
Theory	of Sup	erconduction			11-TSL-092-m01
Module coordinator				Module offered by	
	ing Dire trophys	ector of the Institute of Th ics	eoretical Physics	Faculty of Physics a	and Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
5		rical grade			
Duratio	on	Module level	Other prerequisites		
sessment. The lectur at the beginning of th sidered a declaration dents have obtained the course of the sen sessment into effect. ted to assessment in		es must be met to qualify for admission to as- urer will inform students about the respective details the course. Registration for the course will be con- on of will to seek admission to assessment. If stu- ed the qualification for admission to assessment over emester, the lecturer will put their registration for as- ct. Students who meet all prerequisites will be admit- in the current or in the subsequent semester. For as- date, students will have to obtain the qualification for			
Conter			admission to assess	sinch ancw.	
Phenor vity (Ar elemer Intende The stu	menolo ndreev s nts. ed learn udents l operties	gical theory of supercond scattering, Bobolioubov- ning outcomes nave basic knowledge of	ductivity (Ginzburg-La de Gennes equation, the theoretical mode	andau theory). Meso SQUIDS). Quantum	aperconductivity (BCS theory). scopic aspects of superconducti- computing with superconductive n of superconductivity. They know ulation methods to simple pro-
		umber of weekly contact hours, l	anguage — if other than Ger	rman)	
		mation on SWS (weekly o			able)
		<b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, o	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					
Allocat	Allocation of places				
Additio	Additional information				
Worklo	ad				
Teaching cycle					

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## Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation	
Physics of Complex Systems			11-PKS-092-m01	
Module coordinator		Module offered by		
Managing Director of the Institute and Astrophysics	of Theoretical Physics	Faculty of Physics a	ind Astronomy	
ECTS Method of grading	Only after succ. con	npl. of module(s)		
6 numerical grade				
Duration Module level	Other prerequisites			
1 semester graduate	sessment. The lecture at the beginning of the sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i	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		
Contents				
<ol> <li>Theory of critical phenomena in</li> <li>Introduction into the physics of</li> <li>Entropy production and fluctua</li> <li>Phase transitions away from eq</li> <li>Universalityt</li> <li>Spin glassest</li> <li>Theory of neural networks</li> </ol>	ut of equilibriumt tionst			
Intended learning outcomes				
The students have specific and ac methods of Statistical Physics, Co such systems. They are able to wo	omputational Physics and	non-linear dynamics		
Courses (type, number of weekly contact h	ours, language — if other than Ger	rman)		
R + V (no information on SWS (we	ekly contact hours) and co	ourse language avail	able)	
Method of assessment (type, scope, module is creditable for bonus)	language — 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. Language of assessment: German, English				
Allocation of places				
Additional information				
Workload				

## Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2010)

Modul	e title				Abbreviation	
Quantı	um Info	rmation and Quantur	n Computing		11-QIC-092-m01	
Module coordinator				Module offered by		
	ing Dire trophys		of Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 semester graduate		graduate	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	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	te					
tron sp states. Intende The stu They an	in state ed learn idents l re able	es. The third part cove ning outcomes have an advanced un to solve simple probl	ers the description and e	xplanation of decoh theory and basic kn tion theory.	nipulation of coherent two-elec- erence of quantum mechanical	
	_		kly contact hours) and co		lable)	
Metho	d of ass				ot every semester, information on whether	
a) writt groups project (appro Assess and wi examir	en exa (appro report x. 30 m ment o ll be an	mination (approx. 90 x. 30 minutes per cal (approx. 8 to 10 page inutes) ffered: When and ho	ndidate, for modules with es, time to complete: 1 to w often assessment will under observance of Se	h less than 4 ECTS c 4 weeks) or d) pres be offered depends	idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and	
Allocat	tion of p	olaces				
Additio	onal inf	ormation				
 Worklo	oad					
Teachi	ng 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)

Module	title				Abbreviation	
Statisti	ics, Dat	a Analysis and Compu	ter Physics		11-SDC-092-m01	
Module	Module coordinator			Module offered by		
Managing Director of the Institute of Applied Physics			Applied Physics	Faculty of Physics and Astronomy		
ECTS		od of grading	Only after succ. con			
4		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					
Statisti	cs, dat	a analysis and comput	er physics.			
Intende	ed lear	ning outcomes				
The stu Physics		nave specific and adva	nced knowledge in the	field of statistics, da	ata analysis and Con	nputational
Course	<b>S</b> (type, r	umber of weekly contact hour	s, language — if other than Gei	rman)		
R + V (n	io infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
module is	creditab	le for bonus)	guage — if other than German,			
groups project (approx Assess and wil examin Langua	(appro report <. 30 m ment o l be an ation r ge of a	x. 30 minutes per cand (approx. 8 to 10 pages inutes) ffered: When and how nounced in due form u egulations) 2009. ssessment: German, E	ninutes) or b) oral exam lidate, for modules with , time to complete: 1 to often assessment will h nder observance of Sec nglish	n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o	edits approx. 20 min entation/seminar pro on the method of as:	nutes) or c) esentation sessment
Allocat	ion of p	olaces				
 Additio	nal inf	ormation				
Worklo	ad					
Teachir	ig cycl	9				
 Doform-	d to :					
Keierre		LFUI (examination regulati	ons for teaching-degree progra	mmes)		
Module	annor	in in				
Bachel	or' deg	ree (1 major) Physics (2 ree (1 major) Physics (2				
Bachelor's (2009)	with 1 ma	or Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische	-	page 87 / 156

WÜRZBURG
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)

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

Julius-Maximilians-UNIVERSITÄT

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

Module	e title			Abbreviation	
Cosmo	logy				11-AKM-092-m01
Module	e coord	inator		Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics			Theoretical Physics	Faculty of Physics a	and Astronomy
ECTS		od of grading	Only after succ. con	npl. of module(s)	
6	nume	rical grade		-	
Duratio	on	Module level	Other prerequisites		
1 semester graduate		sessment. The lecture at the beginning of the sidered a declaration dents have obtained the course of the set sessment into effect ted to assessment i	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	- I		
matter,	, primo	rdial nucleosynthesis,		kground, structure fo	e early universe, inflation, dark ormation, supercluster, galaxies
Intend	ed lear	ning outcomes			
	late the	em to observations. The			ethods of cosmology and are ab- th topics and are able to work on
			rs, language — if other than Ger		
			y contact hours) and co		
		sessment (type, scope, lang ble for bonus)	guage — if other than German,	examination offered — if no	ot every semester, information on whether
groups project (approz Assess and wil examin	(appro report x. 30 m ment o Il be an ation r	ox. 30 minutes per cano (approx. 8 to 10 pages inutes) iffered: When and how	lidate, for modules with , time to complete: 1 to often assessment will l inder observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and
Allocat	ion of <sub>l</sub>	places			
Additio	onal inf	ormation			
	-				
Worklo	ad				
Teachi	ng cycl	e			
 Referre	ed to in	<b>LPO I</b> (examination regulati	ions for teaching-degree progra	immes)	
				,	

Plasma	e title				Abbreviation	
	a-Astro	physics			11-APL-092-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Theoretical Physics and Astrophysics			Faculty of Physics a	and Astronomy		
ECTS Method of grading Only after succ. compl. of module(s)						
6		rical grade		•		
Duratio	on	Module level	Other prerequisites	i		
1 semester graduate Certain pro- sessment. at the beg sidered a dents have the course sessment ted to asset			sessment. The lecture at the beginning of sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i	is must be met to qu irer will inform stude the course. Registrat on of will to seek adm d the qualification for mester, the lecturer t. Students who mee n the current or in th date, students will h sment anew.	nts about the resp ion for the course on hission to assessm or admission to ass will put their regist et all prerequisites e subsequent sem	ective details will be con- ent. If stu- essment over tration for as- will be admit- ester. For as-
Conten	Its					
The stu motion compa <b>Course</b>	idents and a re and <b>s</b> (type, i	ning outcomes have basic knowledge of cceleration of charged p evaluate theory and ex number of weekly contact hour rmation on SWS (weekly	particles in space, they periments. s, language — if other than Ge	know corresponding	g measuring metho	
		sessment (type, scope, lang	·			ation on whether
		ble for bonus)			st every semester, morni	ation on whether
	en exa	mination (approx oo m	vinutes) or b) oral exam			
groups project (approz Assess and wil examin	(appro report x. 30 m ment o Il be ar nation r	(approx. 90 minutes per cand (approx. 8 to 10 pages inutes) Iffered: When and how mounced in due form u regulations) 2009.	lidate, for modules with, time to complete: 1 to often assessment will nder observance of Se	h less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	entation/seminar p on the method of a	ninutes) or c) presentation ssessment
groups project (approz Assess and wil examir Langua	(appro report x. 30 m ment o Il be ar nation r age of a	ox. 30 minutes per cand (approx. 8 to 10 pages inutes) Iffered: When and how inounced in due form u regulations) 2009.	lidate, for modules with, time to complete: 1 to often assessment will nder observance of Se	h less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	redits approx. 20 m entation/seminar p on the method of a	ninutes) or c) presentation ssessment
groups project (approz Assess and wil examir Langua Allocat	(appro report x. 30 m ment c Il be ar nation r age of a tion of	ox. 30 minutes per cand (approx. 8 to 10 pages inutes) Iffered: When and how inounced in due form u regulations) 2009.	lidate, for modules with, time to complete: 1 to often assessment will nder observance of Se	h less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	redits approx. 20 m entation/seminar p on the method of a	ninutes) or c) presentation ssessment
groups project (appro: Assess and wil examir Langua Allocat  Additic	(approd report x. 30 m ment o ll be ar nation r age of a <b>ion of</b>	ox. 30 minutes per cand (approx. 8 to 10 pages inutes) offered: When and how nounced in due form u regulations) 2009. Issessment: German, En places	lidate, for modules with, time to complete: 1 to often assessment will nder observance of Se	h less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	redits approx. 20 m entation/seminar p on the method of a	ninutes) or c) presentation ssessment
groups project (approz Assess and wil examir Langua Allocat	(approd report x. 30 m ment o ll be ar nation r age of a <b>ion of</b>	ox. 30 minutes per cand (approx. 8 to 10 pages inutes) offered: When and how nounced in due form u regulations) 2009. Issessment: German, En places	lidate, for modules with, time to complete: 1 to often assessment will nder observance of Se	h less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	redits approx. 20 m entation/seminar p on the method of a	ninutes) or c) presentation ssessment
groups project (appro: Assess and wil examir Langua Allocat  Additic  Worklo	(approd report x. 30 m ment o Il be an nation r age of a <b>ion of</b>	ox. 30 minutes per cand (approx. 8 to 10 pages inutes) offered: When and how inounced in due form u regulations) 2009. Issessment: German, En places	lidate, for modules with, time to complete: 1 to often assessment will nder observance of Se	h less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	redits approx. 20 m entation/seminar p on the method of a	ninutes) or c) presentation ssessment
groups project (appro: Assess and wil examir Langua Allocat  Additio  Worklo	(approd report x. 30 m ment o Il be an nation r age of a <b>ion of</b>	ox. 30 minutes per cand (approx. 8 to 10 pages inutes) offered: When and how inounced in due form u regulations) 2009. Issessment: German, En places	lidate, for modules with, time to complete: 1 to often assessment will nder observance of Se	h less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	redits approx. 20 m entation/seminar p on the method of a	ninutes) or c) presentation ssessment
groups project (appro: Assess and wil examir Langua Allocat  Additic	(approd report x. 30 m ment o Il be an nation r age of a <b>ion of</b>	ox. 30 minutes per cand (approx. 8 to 10 pages inutes) offered: When and how inounced in due form u regulations) 2009. Issessment: German, En places	lidate, for modules with, time to complete: 1 to often assessment will nder observance of Se	h less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	redits approx. 20 m entation/seminar p on the method of a	ninutes) or c) presentation ssessment

### Module appears in

Module title					Abbreviation	
Group Theory					11-GRT-092-m01	
Module	coord	inator		Module offered by		
Managing Director of the Institute of The and Astrophysics			Theoretical Physics	Faculty of Physics and 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		sessment. The lecture at the beginning of the sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i	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					
Group t	heory.	Finite groups. Lie grou	ps. Lie algebra. Depicti	on. Tensors. Classifi	cation theorem. App	lications.
Intende	d learr	ning outcomes				
group tl	heory a		up theory, especially of sing the acquired methologies.			
Courses	<b>5</b> (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 availa	able)	
		essment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
groups project (approx Assessi and will	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				
 Additio	nal info	ormation				
Worklo	ad					
Teaching cycle						
	<u> </u>					
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	immes)		
Module	appea	rs in				
Bachelor's	with 1 mai	or Mathematical Physics	IMII Würzburg •	generated 26-Aug-2024 • exa	am, reg. da-	page 93 / 156
(2009)				r (180 ECTS) Mathematische F	-	P~5~ 7) / 100

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)

Numor	e title				Abbreviation
Hamel	rical Mo	ethods in Astrophysi	cs		11-NMA-092-m01
Module coordinator				Module offered by	1
Managing Director of the Institute of Theoretical Physics and Astrophysics			of Theoretical Physics	Faculty of Physics a	
ECTS     Method of grading     Only after succ. compl. of module(s)					
6		erical grade		1	
Durati	on	Module level	Other prerequisites	6	
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 assessment anew.		
Conter	nts				
CL).		as of high-performant rning outcomes	e computing. Message-p	assing interface (Mi	PI). GPGPU programming (Open-
The stu	udents	are able to solve typ			and other subdisciplines of Phy- osing adequate strategies to ap-
The stu sics wi	udents ith the	are able to solve typ	nulations. They are espec		and other subdisciplines of Phy- osing adequate strategies to ap-
The stu sics wi proach <b>Course</b>	udents ith the n such <b>es</b> (type,	are able to solve typ help of numerical sin problems and of valio number of weekly contact h	nulations. They are espec dating the results. hours, language — if other than Ge	ially capable of choo	osing adequate strategies to ap-
The stu sics wi proach <b>Course</b> V + Ü (	udents ith the n such <b>es</b> (type, (no info	are able to solve typ help of numerical sin problems and of valio number of weekly contact h prmation on SWS (we	nulations. They are espec dating the results. Hours, language — if other than Ge ekly contact hours) and co	ially capable of choo man) ourse language avai	osing adequate strategies to ap-
The stu sics wi proach Course V + Ü ( Metho module i	udents ith the n such es (type, no info od of as	are able to solve typ help of numerical sin problems and of valid number of weekly contact h prmation on SWS (we seessment (type, scope, l ble for bonus)	nulations. They are espec dating the results. hours, language — if other than Ge ekly contact hours) and co language — if other than German,	ially capable of choo rman) ourse language avai examination offered — if n	lable) ot every semester, information on whether
The stu sics wi proach <b>Course</b> V + Ü ( <b>Metho</b> module i a) writh groups project (appro Assess and wi examin	udents ith the n such es (type, fino info d of as is credita ten exa s (appro- t report ox. 30 n sment o ill be an nation	are able to solve typi help of numerical sin problems and of valid number of weekly contact h ormation on SWS (week seessment (type, scope, l ble for bonus) amination (approx. 90 ox. 30 minutes per ca t (approx. 8 to 10 pag ninutes) offered: When and ho	nulations. They are espected dating the results.	ially capable of choo rman) ourse language avai examination offered — if n nination of one cand h less than 4 ECTS co 4 weeks) or d) pres be offered depends	osing adequate strategies to ap-
The stu sics wi proach <b>Course</b> V + Ü ( <b>Metho</b> module i a) writh groups project (appro Assess and wi examin Langua	udents ith the n such es (type, fno info d of as is credita ten exa s (appro- t report x. 30 n sment o ill be an nation age of a	are able to solve typ help of numerical sin problems and of valid number of weekly contact h ormation on SWS (week seessment (type, scope, l ble for bonus) amination (approx. 90 ox. 30 minutes per ca t (approx. 8 to 10 pag ninutes) offered: When and ho nnounced in due form regulations) 2009.	nulations. They are espected dating the results.	ially capable of choo rman) ourse language avai examination offered — if n nination of one cand h less than 4 ECTS co 4 weeks) or d) pres be offered depends	lable) ot every semester, information on whether idate each or oral examination ir redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment
The stu sics wi proach <b>Course</b> V + Ü ( <b>Metho</b> module i a) writh groups project (appro Assess and wi examin Langua	udents ith the n such es (type, fno info d of as is credita ten exa s (appro- t report x. 30 n sment o ill be an nation age of a	are able to solve typ help of numerical sin problems and of valio number of weekly contact h ormation on SWS (week issessment (type, scope, l ble for bonus) amination (approx. 90 ox. 30 minutes per ca t (approx. 8 to 10 pag ninutes) offered: When and ho nnounced in due form regulations) 2009. assessment: German	nulations. They are espected dating the results.	ially capable of choo rman) ourse language avai examination offered — if n nination of one cand h less than 4 ECTS co 4 weeks) or d) pres be offered depends	lable) ot every semester, information on whether idate each or oral examination ir redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment
The stu sics wi proach <b>Course</b> V + Ü ( <b>Metho</b> module i a) writh groups project (appro Assess and wi examin Langua	udents ith the n such es (type, ino info d of as is credita ten exa s (appro t report x. 30 n sment o ill be an nation age of a tion of	are able to solve typ help of numerical sin problems and of valio number of weekly contact h ormation on SWS (week issessment (type, scope, l ble for bonus) amination (approx. 90 ox. 30 minutes per ca t (approx. 8 to 10 pag ninutes) offered: When and ho nnounced in due form regulations) 2009. assessment: German	nulations. They are espected dating the results.	ially capable of choo rman) ourse language avai examination offered — if n nination of one cand h less than 4 ECTS co 4 weeks) or d) pres be offered depends	lable) ot every semester, information on whether idate each or oral examination ir redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment
The stu sics wi proach <b>Course</b> V + Ü ( <b>Metho</b> module i a) writh groups project (appro Assess and wi examin Langua <b>Alloca</b> 	udents ith the n such es (type, ino info d of as is credita ten exa s (appro t report x. 30 n sment o ill be an nation age of a tion of	are able to solve typ help of numerical sin problems and of valid number of weekly contact h ormation on SWS (week seessment (type, scope, l ble for bonus) amination (approx. 90 ox. 30 minutes per ca t (approx. 8 to 10 pag ninutes) offered: When and ho nnounced in due form regulations) 2009. assessment: German <b>places</b>	nulations. They are espected dating the results.	ially capable of choo rman) ourse language avai examination offered — if n nination of one cand h less than 4 ECTS co 4 weeks) or d) pres be offered depends	lable) ot every semester, information on whether idate each or oral examination ir redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment
The stu sics wi proach <b>Course</b> V + Ü ( <b>Metho</b> module i a) writh groups project (appro Assess and wi examin Langua <b>Alloca</b> 	udents ith the n such es (type, ino info d of as is credita ten exa s (appro t report x. 30 n sment o ill be an nation age of a tion of	are able to solve typ help of numerical sin problems and of valid number of weekly contact h ormation on SWS (week seessment (type, scope, l ble for bonus) amination (approx. 90 ox. 30 minutes per ca t (approx. 8 to 10 pag ninutes) offered: When and ho nnounced in due form regulations) 2009. assessment: German <b>places</b>	nulations. They are espected dating the results.	ially capable of choo rman) ourse language avai examination offered — if n nination of one cand h less than 4 ECTS co 4 weeks) or d) pres be offered depends	lable) ot every semester, information on whether idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment
The stu sics wi proach <b>Course</b> V + Ü ( <b>Metho</b> module i a) writh groups project (appro Assess and wi examin Langua <b>Alloca</b>  <b>Additio</b>	udents ith the n such es (type, ino info d of as is credita ten exa s (appro- treport x. 30 n sment o ill be an nation age of a tion of onal in	are able to solve typi help of numerical sin problems and of valid number of weekly contact h ormation on SWS (week seessment (type, scope, l ble for bonus) amination (approx. 90 ox. 30 minutes per ca t (approx. 8 to 10 pag ninutes) offered: When and ho nnounced in due form regulations) 2009. assessment: German places	nulations. They are espected dating the results.	ially capable of choo rman) ourse language avai examination offered — if n nination of one cand h less than 4 ECTS co 4 weeks) or d) pres be offered depends	lable) ot every semester, information on whether idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment
The stu sics wi proach <b>Course</b> V + Ü ( <b>Metho</b> module i a) writh groups project (appro Assess and wi examin Langua <b>Alloca</b>  <b>Additio</b>	udents ith the n such es (type, ino info d of as is credita ten exa s (appro t report x. 30 n sment o ill be an nation age of a tion of	are able to solve typi help of numerical sin problems and of valid number of weekly contact h ormation on SWS (week seessment (type, scope, l ble for bonus) amination (approx. 90 ox. 30 minutes per ca t (approx. 8 to 10 pag ninutes) offered: When and ho nnounced in due form regulations) 2009. assessment: German places	nulations. They are espected dating the results.	ially capable of choo rman) ourse language avai examination offered — if n nination of one cand h less than 4 ECTS co 4 weeks) or d) pres be offered depends	lable) ot every semester, information on whether idate each or oral examination ir redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment
The stu sics wi proach <b>Course</b> V + Ü ( <b>Metho</b> module i a) writh groups project (appro Assess and wi examin Langua <b>Alloca</b>  <b>Additio</b>	udents ith the n such es (type, ino info d of as is credita ten exa s (appro- treport x. 30 n sment o ill be an nation age of a tion of onal in	are able to solve typi help of numerical sin problems and of valid number of weekly contact h ormation on SWS (week seessment (type, scope, l ble for bonus) amination (approx. 90 ox. 30 minutes per ca t (approx. 8 to 10 pag ninutes) offered: When and ho nnounced in due form regulations) 2009. assessment: German places	nulations. They are espected dating the results.	ially capable of choo rman) ourse language avai examination offered — if n nination of one cand h less than 4 ECTS co 4 weeks) or d) pres be offered depends	lable) ot every semester, information on whether idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment

### Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Mathematical Physics (2009) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) FOKUS Physics (2010)

Modul	e title				Abbreviation	
Quanti	um Fiel	d Theory II			11-QFT2-092-m01	_
Module coordinator				Module offered by	le offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics			Faculty of Physics a	ind Astronomy		
ECTS Method of grading Only after succ. compl. of m			npl. of module(s)			
6	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 fo admission to assessment anew.				
Conter	nts					
		theory II. Generating f ntaneous symmetry bre	_		Renormalisation g	roup. Gauge
		ning outcomes				
red the proble	e princi ms of c	have advanced knowle ples, especially of reno uantum field theory by number of weekly contact hour	rmalisation and gauge using the acquired cal	theories. They are al culation methods.		
		rmation on SWS (week)			able)	
Metho	d of as	sessment (type, scope, lang ole for bonus)				ation on whether
groups project (appro Assess and wi examir	s (appro t report ox. 30 m sment o ill be ar nation r	mination (approx. 90 m ox. 30 minutes per canc (approx. 8 to 10 pages inutes) offered: When and how mounced in due form u regulations) 2009. Issessment: German, E	lidate, for modules with , time to complete: 1 to often assessment will I nder observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o	edits approx. 20 m entation/seminar p on the method of as	inutes) or c) resentation ssessment
Allocat	tion of	places				
Additio	onal inf	ormation				
Worklo	oad					
ſeachi	ing cycl	e				
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	immes)		

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 Abbrevia					Abbreviation	
Renorm	nalizati	on Theory			11-RNT-092-m01	
Module	e coord	inator		Module offered by		
Managi and Ast		ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
6	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 admission to assessment anew.				
Conten	tc			inent anew.		
behavio levance ons. Sto berg-M and con Intende The stu	our for e for ph ochast a differ mparis ed learn	dynamics beyond the eq ase diagrams in cryogen ic non-linear partial differ rential equations. Symme on of different RG method ning outcomes have gained an overview	uilibrium. Classical-c ic temperatures. Insta rential equations. Con stries, e.g. in the stoc ds. of renormalisation gr	ritical and quantum- ability of statistical a nstruction of generat hastic Burgers' equa oup methods for not	erential equations with scaling critical phenomena and their re- and dynamic mean-field soluti- ting functionals. Halperin-Hohen- ation (KPZ equation). Introduction n-linear partial differential equa- are able to apply them to specific	
	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
		mation on SWS (weekly o			able)	
Method	d of ass	sessment (type, scope, langua			t every semester, information on whether	
groups project (approx Assess and wil examin	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)

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Module appears in

Bachelor's with 1 major Mathematical Physics

(2009)

Module title Abbreviation					
Relativistical	Quantumfield Theory			11-RQFT-092-m01	
Module coordinator			Module offered by	red by	
Managing Dir and Astrophy	ector of the Institute of Th sics	neoretical Physics	Faculty of Physics a	and Astronomy	
ECTS Meth					
8 nume	rical grade				
Duration	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			
Contents		admission to asses	sment anew.		
theory. Feynm normalisatior	nan rules. Quantum elect			and interaction. Perturbation ion. Radiative corrections and re-	
		ples and underlying i	mathematics of relat	tivistic quantum field theories.	
They know ho processes in	w to use perturbation the	eory and how to apply m electrodynamics in	/ Feynman rules. The	ey are able to calculate basics cover, they have a basic under-	
Courses (type,	number of weekly contact hours,	language — if other than Ge	rman)		
R + V (no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		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					
Additional in	ormation				
Workload					
Teaching cyc	le				

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### Module appears in

Module	e title				Abbreviation
Theory	of Rela	ativity			11-RTT-092-m01
Module coordinator				Module offered by	1
Managing Director of the Institute of Theoretical Physics and Astrophysics			of Theoretical Physics	Faculty of Physics a	and Astronomy
ECTS		od of grading	Only after succ. con	npl. of module(s)	
6	1	rical grade		•	
Duratio	on in the second	Module level	Other prerequisites		
1 semester graduate		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	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 fo		
Conten	ts				
ments	of diffe	rential geometry; ele		nple of a relativistic §	mmary of special relativity; ele- gauge theory; field equations of Ilation
		ning outcomes			
mather able to <b>Course</b>	natical apply <b>s</b> (type, r	understanding of the the acquired knowled number of weekly contact he		elativity on the basis physics and cosmolo rman)	
Metho	d of as		·		ot every semester, information on whether
groups project (approx Assess and wil examin	(appro report x. 30 m ment o Il be an nation r	ox. 30 minutes per car (approx. 8 to 10 page inutes) Iffered: When and how	ndidate, for modules with es, time to complete: 1 to w often assessment will under observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese be offered depends	idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and
Allocat	ion of	places			
Additio	onal inf	ormation			
	-				
Worklo	ad				
 Teachiı	ng cycl	e			
 Referre	ed to in	LPO I (examination regul	ations for teaching-degree progra	immes)	
		ior Mathematical Disso	1840 1 18725	concepted of August	am. reg. da- page 103 / 156
sachelor's	with 1 ma	jor Mathematical Physics	JMU Würzburg •	generated 26-Aug-2024 • ex	

Module title Abbreviation				
Theoretical E	lementary Particle Physic	CS		11-TEP-092-m01
Module coord	linator		Module offered by	
Managing Dir and Astrophy	ector of the Institute of Th sics	neoretical Physics	Faculty of Physics a	and Astronomy
ECTS Meth	thod of grading Only after succ. compl. of module(s)			
8 nume	rical grade			
Duration	Module level	Other prerequisites		
sessment. The lat the beginning sidered a declar dents have obta the course of the sessment into e ted to assessme			rer will inform stude the course. Registrat on of will to seek adn d the qualification for mester, the lecturer t. Students who mee n the current or in th date, students will h	alify for admission to as- ents about the respective details tion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- ne subsequent semester. For as- nave to obtain the qualification fo
Contents	I	admission to asses	sment anew.	
Gauge theorie				ples of quantum field theory. . Quantum chrome dynamics. Ex-
Intended lear	ning outcomes	-		
structure of th lation method	ne standard model based	on symmetry princip imple problems and p	les and experimenta processes of Elemen	e Physics. They understand the al observations. They know calcu- tary Particle Physics. Furthermo- nded theories.
	number of weekly contact hours,			
R + V (no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)
		age — if other than German,	examination offered — if no	ot 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				
Allocation of	places			
Additional inf	formation			
Workload				
Teaching cyc	le			

### Module appears in

Module title					Abbreviation	
Experimental Particle Physics					11-TPE-092-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of A		pplied Physics Faculty of Physics and Astronomy				
ECTS Method of grading		Only after succ. con	Only after succ. compl. of module(s)			
4 numerical grade						
Duration		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.			
Contents						
Physics with modern particle detectors at the LHC and at the Tevatron. Discovery of the Higgs boson. Search for supersymmetry and other physics beyond the standard model. Determination of the top quark mass and W mass as well as other parameters of the standard model. Introduction to modern methods of analysis and assessment of systematic errors.						
Intended learning outcomes						
The students are familiar with the principles of modern particle detector physics, especially with currently open questions of Particle Physics, which are examined by using these detectors. They know modern methods of analysis and are able to put results into context and to assess their systematic uncertainties.						
Courses (type, number of weekly contact hours, language — if other than German)						
R + V (no information on SWS (weekly contact hours) and course language available)						
<b>Method of assessment</b> (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						
Allocation of places						
Additional information						
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Bachelor's ( (2009)	with 1 maj	or Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische I		page 107 / 156

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Module	e title				Abbreviation	
Particle	e Physi	cs (Standard Model)			11-TPS-092-m01	
Module	e coord	inator		Module offered by	<u> </u>	
		ectors of the Institute o f Theoretical Physics a		Faculty of Physics a	nd Astronomy	
ECTS		od of grading	Only after succ. con	pl. of module(s)		
8	nume	rical grade		-		
Duratio	on	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 will sidered a declaration of will to seek admission to assessme 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 at a later date, students will have to obtain the qualification to assess the course of the semester at a later date, students will have to obtain the qualification to assessment at a later date, students will have to obtain the qualification to assessment anew.		ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as-				
Conten	ts					
		o the theory of electrov el and determination c	veak interaction and sp	ontaneous symmetr	y breaking. Experim	ents on the
		ning outcomes	I			
perime	nts tha	t have established and	ndamental laws of the I confirmed the standar of the standard model a	d model. They are al	ole to interpret expe	
			s, language — if other than Ger			
			y contact hours) and co			
		s <b>essment</b> (type, scope, lang le for bonus)	guage — if other than German, o	examination offered — if no	t every semester, informat	ion on whether
groups project (appro» Assess and wil examin Langua	(appro report x. 30 m ment o Il be an nation r ige of a	x. 30 minutes per cand (approx. 8 to 10 pages inutes) ffered: When and how nounced in due form u egulations) 2009. ssessment: German, E	ninutes) or b) oral exam lidate, for modules with , time to complete: 1 to often assessment will h nder observance of Sec nglish	n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o	edits approx. 20 mir entation/seminar pro on the method of as:	nutes) or c) esentation sessment
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachiı	ig cycl	e				
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	mmes)		
		or Mathematical Physics	1841114/** 1	generated 26-Aug-2024 • ex		

#### 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)

Bachelor's with 1 major Mathematical Physics

(2009)

Module	e title				Abbreviation
Supers	symmet	ry I and II		,	11-SUS-092-m01
Module	e coord	inator		Module offered by	
Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics		and 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 semestergraduateCertain prerequisites must be met to qualify for admission to as sessment. The lecturer will inform students about the respectiv at the beginning of the course. Registration for the course will b sidered a declaration of will to seek admission to assessment. dents have obtained the qualification for admission to assess n the course of the semester, the lecturer will put their registration sessment into effect. Students who meet all prerequisites will b ted to assessment in the current or in the subsequent semester sessment at a later date, students will have to obtain the qualifi admission to assessment anew.		Ints about the respective details ion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- e subsequent semester. For as-			
persym	symmet nmetry:	Algebra and multiplets.	Superfield formalism	. Breaking of supers	puszanski-Sohnius theorem. Su- ymmetry. spectrum of supersymmetric par-
					s models. Violation of R-parity.
Intende	ed lear	ning outcomes			
tric mo	dels. Tl		y's formalism and red		persymmetry and supersymme- ons to other models as well as its
Course	<b>S</b> (type, r	umber of weekly contact hours, l	anguage — if other than Ger	rman)	
V + R (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
		<b>eessment</b> (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	ot every semester, information on whether
groups project (approx Assess and wil examin	(appro report x. 30 m ment o Il be an nation r	x. 30 minutes per candid (approx. 8 to 10 pages, ti inutes) ffered: When and how of	ate, for modules with ime to complete: 1 to ten assessment will h ler observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o	idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and
Allocat	-	-			
Additio	onal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			

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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) Computational Mathematics (2012) Master's degree (1 major) FOKUS Physics (2006)

Module	e title				Abbreviation
Conder	ised Ma	atter (Quanta, Atoms, Mo	olecules, Solid State	Physics)	11-KM-092-m01
Module	coord	inator		Module offered by	
Managi	ng Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
16	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
2 seme	ster	undergraduate			
Conten	ts				
Quantu Atoms mical b (FEG). (	in Physin exter onding Crystal	sics. Mathematical formu mal fields. Many-electror g. Molecule rotations and	lation of quantum mo atoms. Optical trans vibrations. Bonding lattice. Structure dete	echanics. Quantum i sitions and spectrose in crystals. Mechani	ls. Experimental principles of mechanics of hydrogen atoms. copy. Laser. Molecules and che- cal properties. Free electron gas ibrations (phonons). Thermal
Intende	ed learr	ning outcomes	·		
The stu ding an They ar	dents l d struc e able i	know the basic contexts at the transformer to the t	nermal properties, pri ethods to the formula	nciples of electronic ation of modern phy	tomic Physics and solids (bon- properties (free electron gas)). sical contexts and autonomously
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
kly con Konder hours)	tact ho isierte + Ü (2 v	urs) + Ü (2 weekly contac Materie 2 (Festkörperphy veekly contact hours), or	et hours), once a year vsik 1) (Condensed Ma nce a year (summer se	(winter semester) atter 2 (Solid State P emester)	ita, Atoms, Molecules)): V (4 wee- hysics)): V (4 weekly contact
		le for bonus)	ge — If other than German, e	examination offered — if no	t every semester, information on whether
1. Topio amin 2. Topio amin 3. Topio	ation ( ation ( cs cove ation ( cs cove	approx. 120 minutes). red in lectures and exerc approx. 120 minutes).	ises in part 1 (Konder ises in part 2 (Konder ises in parts 1 and 2:	nsierte Materie 2 (Co oral examination of	ndensed Matter 1)): written ex- ondensed Matter 2)): written ex- one candidate each (approx. 30
Succes ponent To qual Studen	sful con s 1 and ify for a ts are h	2. admission to assessmen highly recommended to a	of practice work each t component 3, stude ttend both courses K	n is a prerequisite fo onts must pass asses ondensierte Materie	n examiner(s). r admission to assessment com- ssment component 1 and/or 2. 1 (Condensed Matter 1) and o courses will be covered in as-
sessme Studen To pass compor The gra	ent com ts mus s this m nent 3. de ach	pponent 3. t register for assessment nodule, students must fir	components 1 throug st pass assessment c 1ponent 1 or 2 (which	gh 3 online (details t component 1 or 2 and ever is better) and tl	o be announced). d must then pass assessment ne grade achieved in assessment
Allocat	ion of p	olaces			

Additional information
Workload
Teaching cycle
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)
Module appears in
Bachelor' degree (1 major) Mathematics (2012)
Bachelor' degree (1 major) Mathematics (2013)
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Bachelor' degree (1 major) Computational Mathematics (2012)
Bachelor' degree (1 major) Computational Mathematics (2013)
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module	e title				Abbreviation	
Nuclea	r and E	lementary Particle Physi	cs		11-KET-092-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ing Director of the Institute of Applied Physics Faculty of Physics and Astronomy				
ECTS	Metho	od of grading	Only after succ. con	. compl. of module(s)		
4	nume	rical grade				
Duratio	on	Module level	Other prerequisites	es		
1 semester 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 fo			ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as-	
Conten	its		admission to assess			
Nuclea ticles. model.	r mode Symme Curren	of Nuclear and Elementa ls. Radioactive decay. St tries. Particle accelerator t results.	ructure of nuclei. Nuc	lear energy. Quantu	m theoretical descri	ption of par-
Intend	ed lear	ning outcomes				
	ave an	understand the basic cor overview of the experime				
Course	<b>S</b> (type, r	number of weekly contact hours, I	anguage — if other than Ger	rman)		
V + Ü (I	no infoi	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	ot every semester, informat	ion on whether
	examii ise spe	nation (approx. 120 minu cified)	tes, for modules with	less than 4 ECTS cr	edits approx. 90 mir	nutes; unless
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination regulation	s for teaching-degree progra	mmes)		
Module	e appea	urs in				
Bachel Bachel	or' deg or' deg	ree (1 major) Physics (20 ree (1 major) Mathematic gree (1 major, 1 minor) Ph	al Physics (2009)			
		ior Mathematical Physics		generated 26-Aug-2024 • ex		1 1 1

Modul	e title				Abbreviation
Theore	etical As	strophysics			11-AST-092-m01
Modul	e coord	inator		Module offered by	
	ing Dir trophy		of Theoretical Physics	Faculty of Physics	and Astronomy
ECTS	Meth	od of grading	Only after succ. compl. of module(s)		
6	nume	rical grade			
Duratio	on	Module level	Other prerequisites	5	
1 seme	ester	graduate			
Conter	nts				
Theore	tical As	trophysics, models f	or the description of con	nplex observation re	sults, numeric simulations.
		ning outcomes	· ·	•	
	-		e of the methods of Theo	oretical Astrophysics	. They are able to design complex
			ls with the help of simul		, , ,
Course	<b>S</b> (type, 1	number of weekly contact ho	ours, language — if other than Ge	erman)	
R + V (1	no infoi	mation on SWS (wee	kly contact hours) and c	ourse language avai	lable)
Metho	d of as	<b>sessment</b> (type, scope, la	inguage — if other than German,	, examination offered — if n	ot every semester, information on whether
module i	s creditat	le for bonus)			
written	exami	nation (approx. 120 n	ninutes)		
Allocat	tion of	places			
Additio	onal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
	<u> </u>				
Referre	d to in	<b>IPOI</b> (examination regul	ations for teaching-degree progr	rammes)	
Modul	e appea	ars in			
		ree (1 major) Physics	(2010)		
	-	ree (1 major) Physics			
	-	-	atical Physics (2009)		
	-	•	atical Physics (2012)		
	-	ee (1 major) Physics (			
	-	ee (1 major) Physics (			
	-	ee (1 major) Mathema			
	-	ee (1 major) FOKUS P			
	-	ee (1 major) FOKUS P	•		
Master	's degr	ee (1 major) FOKUS P	hysics (2006)		

Module title Abbreviation						
Solid S	tate Ph	lysics 1			11-FKP-092-m01	
Module	coord	inator		Module offered by		
Managi	ng Dire	ector of the Institute of	Applied 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		sessment. The lecture at the beginning of sidered a declaration dents have obtained the course of the set sessment into effect ted to assessment i sessment at a later	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 fo admission to assessment anew.			
Conten	ts					
		of solids: Bonding and lectron gas).	structure, lattice dyna	mics, thermal proper	ties, principles of el	ectronic pro-
Intende	ed learı	ning outcomes				
			ontexts and principles ctronic properties (free		nd structure, lattice	dynamics,
Course	<b>S</b> (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
V + Ü (r	no infor	mation on SWS (week	ly contact hours) and co	ourse language avail	able)	
		s <b>essment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	on on whether
otherwi Assessi	ise spe ment o	cified) ffered: When and how	nutes, for modules with often assessment will inder observance of Se	be offered depends o	on the method of ass	sessment
		egulations) 2009.				
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	ammes)		
Module	appea	ars in				
Bachelo Bachelo	or' deg or' deg	ree (1 major) Mathema ree (1 major) Mathema ree (1 major) Mathema ree (1 major) Mathema	tics (2013) tical Physics (2009)			
Bachelor's ( (2009)	with 1 maj	or Mathematical Physics		generated 26-Aug-2024 • exa r (180 ECTS) Mathematische I	-	page 117 / 156



Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module	e title				Abbreviation	
Quanta	a, Atom	s, Molecules			11-QAM-092-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of	Applied 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	on	Module level	Other prerequisites			
1 semesterundergraduateCertain prerequisites must be met to qualify for admission sessment. The lecturer will inform students about the resp at the beginning of the course. Registration for the course v sidered a declaration of will to seek admission to assessm dents have obtained the qualification for admission to ass the course of the semester, the lecturer will put their regist sessment into effect. Students who meet all prerequisites ted to assessment in the current or in the subsequent sem sessment at a later date, students will have to obtain the c admission to assessment anew.		nts about the respection for the course wints in to assessment admission to assessment admission to assest will put their registration and prerequisites were subsequent semestive semestive semestive subsequent semestive semest	ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as-			
Conten	ts					
Physica	al laws	of Atomic, Quantum ar	nd Molecular Physics.			
Intende	ed lear	ning outcomes				
Quantu	ım mec	hanical atom model, o	basic contexts and prin ne/multi-electron atom and elementary excitati	ns, electronic dipole	transitions, atoms ir	n B field, as
Course	<b>S</b> (type, r	umber of weekly contact hour	s, language — if other than Ge	rman)		
Ü + Ü (I	no info	rmation on SWS (week	ly contact hours) and co	ourse language avail	able)	
		essment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
otherw Assess and wil	ise spe ment o Il be an	cified) ffered: When and how	nutes, for modules with often assessment will l nder observance of Sec	be offered depends o	on the method of ass	sessment
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
	-					
Worklo	ad					
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	ammes)		
Module						
	-	ree (1 major) Mathema ree (1 major) Mathema				
Bachel	or' deg	ree (1 major) Mathema ree (1 major) Mathema ree (1 major) Mathema	tical Physics (2009)			
		or Mathematical Physics		generated 26-Aug-2024 • example 2014	am. reg. da-	page 119 / 156
(2009)			-	r (180 ECTS) Mathematische I	-	



Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)



# **Thesis** (10 ECTS credits)

Modul	e title				Abbreviation	
Thesis	Mathe	matical Physics (Bachelo	or Thesis)		10-M-BAP-092-m01	
Modul	e coord	inator		Module offered by		
Dean c	of Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	undergraduate	Registration for asse	or assessment: as specified.		
Conter	nts					
		y researching and writing ation with the superviso		erdisciplinary) topic i	n mathematics or physics selec-	
Intend	ed lear	ning outcomes				
and ap	ply the	•	, .	, , , ,	topic in mathematics or physics e can write down the result of	
Course	<b>es</b> (type, r	number of weekly contact hours,	language — if other than Gei	rman)		
(no inf	ormatic	on on SWS (weekly conta	ct hours) and course	language available)		
		<b>Sessment</b> (type, scope, langua ole for bonus)	age — if other than German,	examination offered — if no	t every semester, information on whether	
	thesis	ssessment: German, Eng	glish if agreed upon w	vith the examiner		
Allocat	tion of <sub>l</sub>	places				
Additio	onal inf	ormation				
Worklo	bad					
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination regulation	s for teaching-degree progra	ammes)		
Modul	e appea	ars in				
	-	ree (1 major) Mathematio				
Bachel	lor' deg	ree (1 major) Mathematio	cal Physics (2012)			



## Subject-specific Key Skills

(ECTS credits)



## Key Skills 1 (Compulsory)

(5 ECTS credits)

Module	title				Abbreviation
Prepara	atory C	ourse Mathematics			10-M-VKM-082-m01
Module	coord	inator		Module offered by	1
Dean of	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)	
1	(not) s	successfully completed			
Duratio	n	Module level	Other prerequisites	ites	
1 semesterundergraduateAdmission prerequisite to assessment: regular attendance of or specified at the beginning of the course).					
Conten	ts				
Introdu	ction to	o the basic techniques in	mathematics; appro	ach to sets, proposi	tions, propositional logic.
Intende	ed lear	ning outcomes			· · · ·
The stu	dent g			ues which are prere	quisites for the further courses in
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Gei	man)	
V + Ü (r	no infoi	mation on SWS (weekly	contact hours) and co	ourse language avail	able)
		<b>Sessment</b> (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether
Assess	ment o	ments (type and expend ffered: once a year, winte ssessment: German, Eng	er semester		er at the beginning of the course)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ıg cycl	e			
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)	
Module					
Bachelo Bachelo Bachelo Bachelo Bachelo	or' deg or' deg or' deg or' deg or's deg	ree (1 major) Mathematic ree (1 major) Economathe ree (1 major) Economathe ree (1 major) Mathematic ree (1 major) Computatio gree (1 major, 1 minor) M mination for the teaching	ematics (2009) ematics (2008) al Physics (2009) nal Mathematics (20 athematics (Minor, 2	008)	)

Module	title				Abbreviation
Semina	r Mathemati	cal Physics			11-SMP-092-m01
Module	coordinator			Module offered by	
	rson of exam (Mathematic	nination committee al Physics)	e Mathematische	Faculty of Physics a	nd Astronomy
ECTS	Method of g	rading	Only after succ. con	mpl. of module(s)	
4	numerical g	rade			
Duratio	n Modu	ıle level	Other prerequisites	i i	
1 semes	ster unde	rgraduate		quisite to assessment: regular attendance and suc- ion of seminar presentation.	
Content	ts				
A select	ted topic of N	Aathematical Phys	ics.		
Intende	d learning o	utcomes			
sion of a		on the basis of lit			olves the development and divi- ell as the ability to actively partici-
Courses	<b>5</b> (type, number o	of weekly contact hours,	language — if other than Ge	rman)	
S (no in	formation or	n SWS (weekly con	tact hours) and cours	e language available	<u>a</u> )
	of assessme		age — if other than German,	examination offered — if no	t every semester, information on whether
Assessn and will examina	ment offered l be announc ation regulat	ed in due form un ions) 2009.	ften assessment will l	ction 32 Subsection	on the method of assessment 3 ASPO (general academic and
Allocati	on of places				
Additio	nal informati	ion			
Workloa	ad				
Teachin	ig cycle				
Referre	d to in LPO I	(examination regulation	s for teaching-degree progra	immes)	
	appears in				



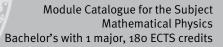
#### Key Skills 2 (Elective)

(ECTS credits)

Students may only take one out of the two modules 10-M-COM and 10-M-COMg or, respectively, out of the two modules 10-M-PRG and 10-M-PRGk.

Modul	e title				Abbreviation		
Astrop	hysics				11-A4-072-m01		
Modul	e coord	inator		Module offered by	<u> </u>		
Manag		ector of the Institute of T	Theoretical Physics	Faculty of Physics a	and Astronomy		
	T	od of grading	Only after succ. con	npl. of module(s)			
6	1	rical grade					
Duratio		Module level	Other prerequisites				
1 seme	ester	undergraduate	Admission prerequi 50% of exercises. Co sion to assessment. ve details at the beg be considered a dec students have obtai over the course of th assessment into eff mitted to assessme assessment at a late for admission to ass	ertain prerequisites The lecturer will inf ginning of the course claration of will to se ned the qualification he semester, the lect ect. Students who m nt in the current or in er date, students wil	must be met to qual orm students about e. Registration for the ek admission to ass n for admission to as turer will put their re teet all prerequisites n the subsequent se	ify for admis- the respecti- course will essment. If seessment gistration for will be ad- mester. For	
Conten			for admission to ass	sessment anew.			
large-s nucleo Intende The stu physica	scale str osynthes ed learn udents a al obse hey kno	n, structure of the Milky ucture of the universe, sis, cosmic microwave b ning outcomes are familiar with the mo rvations and evaluation w the structure of the un	Friedmann World Mod background radiation, dern world view of Ast s. They are able to use	els, thermodynamics structure formation, rophysics. They know these methods to p	s of the early univers inflation w methods and tools lan and analyse own	s for astro- n observati-	
		umber of weekly contact hours	language — if other than Ge	man)			
		mation on SWS (weekly			able)		
Metho	d of ass	<b>essment</b> (type, scope, langule for bonus)				ion on whether	
		nation (approx. 120 min	utes)				
	tion of p						
		f pool of general key ski	ills (ASQ): 15 places. P	laces will be allocate	ed by lot.		
Additio	onal info	ormation					
 Workla							
	ing cycl	e					
	ing cycl	e	_				
 Teachi 		E	ns for teaching-degree progra	mmes)			
 Teachi 			ns for teaching-degree progra	mmes)			
 Teachi  Referre		LPOI (examination regulatio	ns for teaching-degree progra	mmes)			
 Teachi  Referre  Module	ed to in e appea	LPOI (examination regulatio		mmes)			





Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2009) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Physics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (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) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2008) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module	Module title Abbreviation						
Semina	r in An	alysis			10-M-BSA-072-m01		
Module	Module coordinator N						
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 semes	ster	undergraduate					
Conten	ts		·				
A select	ted top	ic in analysis.					
Intende	ed learn	ning outcomes					
of a giv	en topi				sters elaboration and structuring /She is able to participate active-		
Courses	<b>5</b> (type, n	umber 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	2)		
		s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether		
Assessi	ment o	50 minutes) ffered: in the semester in ssessment: German, Eng					
Allocati	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
Teachir	ng cycl	9					
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)			
§ 73 (1)	1. Mat	hematik Analysis					
Module	appea	ins in					
	-	ree (1 major) Mathematic					
Bachelor' degree (1 major) Mathematics (2007)							
	-	ree (1 major) Economathe	-				
	Bachelor' degree (1 major) Economathematics (2008)						
	Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009)						
		gree (1 major, 1 minor) Ma					
		mination for the teaching					

10-M-BSL-072-m01					
Module offered by					
Institute of Mathematics					
succ. compl. of module(s)					
equisites					
nt scientific work. He/She masters elaboration and structuring ares a talk on the subject. He/She is able to participate active					
ther than German)					
and course language available)					
an German, examination offered — if not every semester, information on whether					
course is offered ed upon with the examiner					
egree programmes)					
id Elemente der Zahlentheorie					
Module appears in					
Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)					

Module	Module title Abbreviation						
Semina	ar in Alg	gebra			10-M-BSE-072-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	on	Module level	Other prerequisites				
1 seme	ster	undergraduate					
Conten	Contents						
A selec	ted top	oic in algebra.					
Intende	ed lear	ning outcomes					
of a giv	en topi				sters elaboration and structuring /She is able to participate active-		
Course	<b>S</b> (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	e)		
module is	creditab	le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether		
Assess	ment o	50 minutes) ffered: in the semester in ssessment: German, Eng					
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
Teachi	ng cycl	e					
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)			
§ 73 (1)	2. Mat	hematik Lineare Algebra	, Algebra und Elemen	te der Zahlentheorie			
Module	e appea	ars in					
Bachelo Bachelo Bachelo Bachelo Bachelo	Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009)						
		gree (1 major, 1 minor) Ma mination for the teaching					
inst Sta	First state examination for the teaching degree Gymnasium Mathematics (2009)						

Module	Module title Abbreviation					
Semina	Seminar in Geometry				10-M-BSG-072-m01	
Module	coord	inator		Module offered by		
Dean of	<sup>:</sup> 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 semes	ster	undergraduate				
Content	Contents					
A select	ted top	ic in geometry or differen	itial geometry.			
Intende	d learr	ning outcomes				
of a give	en topi				sters elaboration and structuring /She is able to participate active-	
Courses	<b>5</b> (type, n	umber of weekly contact hours, la	anguage — if other than Ger	man)		
S (no in	format	ion on SWS (weekly cont	act hours) and cours	e language available	)	
module is	creditab	eessment (type, scope, languag le for bonus) 50 minutes)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
		ffered: in the semester in ssessment: German, Eng				
Allocati	on of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachin	ig cycl	e				
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)		
§ 73 (1)	4. Mat	hematik Geometrie				
Module	appea	ins in				
Bachelo	or' deg	ree (1 major) Mathematic	s (2008)			
	-	ree (1 major) Mathematic				
	Bachelor' degree (1 major) Economathematics (2009)					
	Bachelor' degree (1 major) Economathematics (2008)					
	Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009)					
	-	gree (1 major, 1 minor) Ma		•		
		mination for the teaching				

Module	Module title Abbreviation						
Semina	r in Nu	mber Theory		10-M-BSZ-072-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)			
5	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 seme	ster	undergraduate					
Conten	ts						
A selec	ted top	ic in number theory.					
Intende	ed learr	ning outcomes					
of a giv	en topi				sters elaboration and structuring /She is able to participate active-		
Course	<b>S</b> (type, n	umber 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	)		
module is	creditab	le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether		
Assess	ment o	oo minutes) ffered: in the semester in ssessment: German, Eng					
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
Teachir	ng cycl	e					
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)			
§ 73 (1)	2. Mat	hematik Lineare Algebra,	, Algebra und Elemen	te der Zahlentheorie	9		
Module	appea	ars in					
	-	ree (1 major) Mathematic					
	-	ree (1 major) Mathematic					
	Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008)						
Bachelor' degree (1 major) Mathematical Physics (2009)							
	Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009)						
	-	gree (1 major, 1 minor) Ma		•			
		mination for the teaching					

Seminar in Complex Analysis       10-M-BSC-072-m01         Module coordinator       Module offered by         Dean of Studies Mathematik (Mathematics)       Institute of Mathematics					
Dean of Studios Mathematik (Mathematics)					
ECTS Method of grading Only after succ. compl. of module(s)					
5 numerical grade					
Duration Module level Other prerequisites					
1 semester undergraduate					
Contents					
A selected topic in complex analysis.					
Intended learning outcomes					
The student gains first experience with independent scientific work. He/She masters elaboration and structu of a given topic using selected literature, and prepares a talk on the subject. He/She is able to participate ac ly in a scientific discussion.					
<b>Courses</b> (type, number of weekly contact hours, language $-$ if other than German)					
S (no information on SWS (weekly contact hours) and course language available)					
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on wheth module is creditable for bonus)					
talk (approx. 60 minutes) Assessment offered: in the semester in which the course is offered Language of assessment: German, English if agreed upon with the examiner					
Allocation of places					
Additional information					
Workload					
Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
§ 73 (1) 1. Mathematik Analysis					
Module appears in					
Bachelor' degree (1 major) Mathematics (2008)					
Bachelor' degree (1 major) Mathematics (2007)					
Bachelor' degree (1 major) Economathematics (2009)					
Bachelor' degree (1 major) Economathematics (2008)					
Bachelor' degree (1 major) Mathematical Physics (2009)					
Bachelor' degree (1 major) Computational Mathematics (2009)					
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)					

Module	e title				Abbreviation	
Semina	Seminar in Numerical Mathematics 10-M-BSN-072-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	pl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
A selec	ted top	ic in numerical mathema	itics.			
Intende	ed lear	ning outcomes				
of a giv	en topi				sters elaboration and structuring /She is able to participate active-	
		umber of weekly contact hours, l				
S (no ir	format	ion on SWS (weekly cont	act hours) and cours	e language available	e)	
module is	s creditab	S <b>essment</b> (type, scope, langua le for bonus) 50 minutes)	ge — if other than German, o	examination offered — if no	ot every semester, information on whether	
Assess	ment o	ffered: in the semester ir ssessment: German, Eng				
Allocat	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)		
§ 73 (1)	5. Mat	hematik Angewandte Ma	thematik			
Module	e appea	ars in				
	-	ree (1 major) Mathematic				
	Bachelor' degree (1 major) Mathematics (2007)					
	Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008)					
	-	ree (1 major) Economatic				
	-	ree (1 major) Computatio		09)		
		gree (1 major, 1 minor) M				
First sta	ate exa	mination for the teaching	g degree Gymnasium	Mathematics (2009)	)	

Module	Module title Abbreviation						
Semina	r in Ste	ochastics			10-M-BSS-072-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	npl. of module(s)			
5	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 seme	ster	undergraduate					
Conten	ts						
A selec	ted top	ic in stochastics.					
Intende	ed leari	ning outcomes					
of a giv	en topi				sters elaboration and structuring /She is able to participate active-		
Course	<b>S</b> (type, n	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)		
module is talk (ap	creditab	Gessment (type, scope, langua le for bonus) 60 minutes) ffered: in the semester in			ot every semester, information on whether		
		ssessment: German, Eng					
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
Teachir	ng cycl	e					
		LPO I (examination regulation	s for teaching-degree progra	mmes)			
§ 73 (1)	3. Mat	hematik Stochastik					
Module							
	-	ree (1 major) Mathematic					
	Bachelor' degree (1 major) Mathematics (2007)						
	Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008)						
	Bachelor' degree (1 major) Athematical Physics (2008)						
	Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009)						
		gree (1 major, 1 minor) Ma					
		mination for the teaching			)		

Module title					Abbreviation
Semina	r in Fu	nctional Analysis			10-M-BSF-072-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)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
A selec	ted top	oic in functional analysis.			
Intende	ed learı	ning outcomes			
of a giv	en topi	•	•	-	sters elaboration and structuring /She is able to participate active-
Course	<b>S</b> (type, n	number 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	e)
		<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
talk (ap	prox. 6	óo minutes)			
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	e appea	ars in			
Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)					

Module title Abbreviation					Abbreviation
Semina	ar in Op	eration Research			10-M-BSO-072-m01
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
A selec	ted top	ic in operations research	l.		
Intende	ed lear	ning outcomes			
of a giv	en top				sters elaboration and structuring /She is able to participate active-
Course	<b>S</b> (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)
		<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
talk (ap	prox. 6	óo minutes)			
Allocat	ion of <sub>l</sub>	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)	
Module appears in					
Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)					

Module title					Abbreviation
Semina	ar in Di	screte Mathematics			10-M-BSD-072-m01
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
A selec	ted top	oic in discrete mathemation	cs.		
Intende	ed lear	ning outcomes			
of a giv	en top				sters elaboration and structuring /She is able to participate active-
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	rman)	
S (no ir	format	tion on SWS (weekly cont	act hours) and cours	e language available	2)
		<b>sessment</b> (type, scope, langua ıle for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
talk (ap	prox. e	60 minutes)			
Allocat	ion of <sub>l</sub>	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	ars in			
Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)					

Module	e title				Abbreviation		
Compu	tationa	l Mathematics, advance	ed		10-M-COMg-082-m	01	
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics		
ECTS		od of grading	Only after succ. com				
		successfully completed					
4 Duratio		Module level	 Other prevenuicites				
			Other prerequisites		1 11 1	<u> </u>	
1 seme	ster	undergraduate	Admission prerequi: (attendance monito sence).		regular attendance c one incident of unexo		
Contents							
merica 10-M-A	l compi NL and	o modern mathematical utation (e. g. Matlab) to s 10-M-LNA). Computer-b and integral calculus; v	supplement the basic ased solution of probl	modules in analysis lems in linear algebr	and linear algebra	(10-M-ANA,	
Intende	ed lear	ning outcomes					
		arns the use of advance cation to solve mathema		cal software package	es, and is able to as	sess their	
Course	<b>S</b> (type, r	umber of weekly contact hours,	language — if other than Ger	man)			
Ü + V (r	no infoi	mation on SWS (weekly	contact hours) and co	ourse language avail	able)		
		sessment (type, scope, langua	age — if other than German, e	examination offered — if no	ot every semester, informat	ion on whether	
	ige of a	ffered: once a year, sum ssessment: German, Eng <b>blaces</b>		ith the examiner			
Additio	onal inf	ormation					
Worklo	ad						
Teachi	ng cycl	9					
		LPO I (examination regulation		mmes)			
	_	hematik Angewandte Ma	athematik				
Module							
	-	ree (1 major) Mathemati					
	-	ree (1 major) Nanostruct		)			
	Bachelor' degree (1 major) Economathematics (2009)						
	-	ree (1 major) Economath					
	-	ree (1 major) Mathematic ree (1 major) Computatic	• •	20)			
	Bachelor' degree (1 major) Computational Mathematics (2009) Master's degree (1 major) Technology of Functional Materials (2009)						
	-	gree (1 major, 1 minor) N		-			
		mination for the teachin			)		
Bachelor's (2009)	with 1 ma	or Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische	-	page 141 / 156	
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Modul	e title		Abbreviation				
Programming course for students of Mathematics and other subjects, simple 10-M-PRGk-082-mo1							
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathematics)				Institute of Mathematics			
ECTS	Meth	od of grading	Only after succ. con	compl. of module(s)			
2	(not)	successfully completed					
Duration Module level		Module level	Other prerequisites				
1 semester undergraduate		undergraduate	Admission prerequisite to assessment: regular attendance (attendance monitored, a maximum of one incident of unexcused absence).				
Conter	nts						
Basics matics		odern programming langi	uage (e. g. C or Fortra	n) taking into accou	nt the particular needs in mathe-		
Intend	ed lear	ning outcomes					
	udent is hemati		ntly on small program	nming exercises and	standard programming problems		
Course	es (type, i	number of weekly contact hours,	language — if other than Ger	rman)			
P (no ii	nforma	tion on SWS (weekly cont	tact hours) and cours	e language available	e)		
		S <b>essment</b> (type, scope, langua ole for bonus)	ge — if other than German, o	examination offered — if no	ot every semester, information on whether		
project in the form of programming exercises (type and expenditure of time to be specified by the lecturer at the beginning of the course) Language of assessment: German, English if agreed upon with the examiner							
Allocat	tion of	places					
Additio	onal inf	ormation					
Worklo	ad						
Teachi	ng cycl	e					
Referre	ed to in	LPO I (examination regulation	s for teaching-degree progra	immes)			
§ 73 (1)	) 5. Mat	thematik Angewandte Ma	athematik				
Module appears in							
Bachelor' degree (1 major) Mathematics (2008)							
Bachelor' degree (1 major) Nanostructure Technology (2010)							
Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008)							
Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009)							
Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009)							
	Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)						
	First state examination for the teaching degree Gymnasium Mathematics (2009)						

Module	e title	· · · · · · · · · · · · · · · · · · ·		Abbreviation			
Reading Course Numerical Mathematics       10-M-RCN-082-m01							
Module	e coord	linator		Module offered by			
Dean o	f Studi	es Mathematik (Mathe	ematics)	Institute of Mathematics			
ECTS	Meth	Method of grading Only after succ. compl.			ol. of module(s)		
4	nume	rical grade					
Duration Module level Othe			Other prerequisites	ther prerequisites			
1 seme	ster	undergraduate					
Conten	ts						
Advand	ed top	ics in numerical mathe	ematics.				
Intende	ed lear	ning outcomes					
		s able to work indepen use standard literature		tific topic. He or she	e can tackle a simple mathematical		
Course	<b>S</b> (type, 1	number of weekly contact hou	ırs, language — if other than Ge	rman)			
A (no ir	nforma	tion on SWS (weekly c	ontact hours) and cours	se language availab	le)		
		<b>sessment</b> (type, scope, lan ble for bonus)	guage — if other than German,	examination offered — if r	not every semester, information on whether		
a) talk	(appro	x. 30 minutes) or b) wr	itten elaboration (appro	ox. 5 to 10 pages)			
Allocat	ion of	places					
Additio	onal inf	ormation					
Worklo	ad						
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009)							

Module title Abbreviation							
Reading Course Stochastics   10-M-RCS-082-m01							
Modul	e coord	inator		Module offered by	Module offered by		
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathematics			
ECTS	ECTS Method of grading		Only after succ. compl. of module(s)				
4	nume	rical grade					
Duration		Module level	Other prerequisites				
1 seme	ster	undergraduate					
Conten	ts	κ.					
Advand	ced top	ics in stochastics.					
Intend	ed lear	ning outcomes					
The student is able to work independently on a given scientific topic. He or she can tackle a simple mathematical text and can use standard literature.							
Course	<b>S</b> (type, 1	number of weekly contact hours,	language — if other than Ge	rman)			
A (no ii	nforma	tion on SWS (weekly con	tact hours) and cours	e language available	e)		
		<b>Sessment</b> (type, scope, langua ole for bonus)	age — if other than German,	examination offered — if no	ot every semester, information on whether		
a) talk	(appro	x. 30 minutes) or b) writt	en elaboration (appro	ox. 5 to 10 pages)			
Allocat	ion of	places					
Additio	onal inf	ormation					
Worklo	ad						
Teachi	ng cycl	e					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)							
Module appears in							
Bachelor' degree (1 major) Mathematics (2008)							
Bachelor' degree (1 major) Mathematical Physics (2009)							
Bachelor' degree (1 major) Computational Mathematics (2009)							

Modul	e title				Abbreviation	
Readin	Reading Course Discrete Mathematics       10-M-RCD-082-mo1					
Modul	e coord	linator		Module offered by	<u> </u>	
Dean c	of Studi	ies Mathematik (Mathem	atics)	Institute of Mathen	natics	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
4	nume	erical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	undergraduate				
Conter	nts	·				
Basics	in disc	crete mathematics.				
Intend	ed lear	ning outcomes				
		s able to work independe use standard literature.	ently on a given scient	ific topic. He or she	can tackle a simple mathematical	
Course	<b>es</b> (type,	number of weekly contact hours,	language — if other than Ge	rman)		
A (no i	nforma	tion on SWS (weekly con	tact hours) and cours	e language available	e)	
		<b>sessment</b> (type, scope, langu ble for bonus)	age — if other than German,	examination offered — if no	ot every semester, information on whether	
a) talk	(appro	x. 30 minutes) or b) writt	en elaboration (appro	ox. 5 to 10 pages)		
Allocat	tion of	places				
Additio	onal in	formation				
Worklo	oad					
Teachi	ng cyc	le				
Referre	ed to in	LPO I (examination regulation	ns for teaching-degree progra	immes)		
Modul	e appe	ars in				
	-	gree (1 major) Mathemati				
	-	gree (1 major) Mathemati gree (1 major) Computatio		09)		

Modul	e title				Abbreviation
Readin	ig Cour	se Functional Analysis			10-M-RCF-082-m01
Modul	e coord	linator		Module offered by	
Dean o	of Studi	es Mathematik (Mathem	atics)	Institute of Mathen	natics
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
4	nume	erical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conter	nts				
Basics	in fund	ctional analysis.			
Intend	ed lear	ning outcomes			
		s able to work independe use standard literature.	ntly on a given scient	ific topic. He or she	can tackle a simple mathematical
Course	<b>S</b> (type,	number of weekly contact hours,	language — if other than Ge	rman)	
A (no i	nforma	tion on SWS (weekly con	tact hours) and cours	e language availabl	e)
		<b>sessment</b> (type, scope, langua ole for bonus)	age — if other than German,	examination offered — if n	ot every semester, information on whether
a) talk	(appro	x. 30 minutes) or b) writt	en elaboration (appro	ox. 5 to 10 pages)	
Allocat	tion of	places			
			_		
Additio	onal inf	formation			
Worklo	ad				
Teachi	ng cyc	le			
Referre	ed to in	LPO I (examination regulation	is for teaching-degree progra	immes)	
Modul	e appe	ars in			
Bachel Bachel	or' deg or' deg	gree (1 major) Mathematio gree (1 major) Mathematio gree (1 major) Computatio	cal Physics (2009)	09)	

Modul	e title				Abbreviation
Readin	ıg Cour	se Operations Research			10-M-RCO-082-m01
Modul	e coord	linator		Module offered by	
Dean c	Dean of Studies Mathematik (Mathematics)			Institute of Mathen	natics
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
4	nume	erical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ester	undergraduate			
Conter	nts		•		
Basics	in ope	rations research.			
Intend	ed lear	ning outcomes			
		s able to work independe use standard literature.	ntly on a given scient	ific topic. He or she	can tackle a simple mathematical
Course	<b>es</b> (type,	number of weekly contact hours,	language — if other than Ge	rman)	
A (no i	nforma	tion on SWS (weekly con	tact hours) and cours	e language available	e)
		<b>sessment</b> (type, scope, langua ble for bonus)	age — if other than German,	examination offered — if no	ot every semester, information on whether
a) talk	(appro	x. 30 minutes) or b) writte	en elaboration (appro	ox. 5 to 10 pages)	
Allocat	tion of	places			
Additio	onal in	formation			
Worklo	bad				
Teachi	ng cyc	le			
Referre	ed to in	LPOI (examination regulation	s for teaching-degree progra	immes)	
Modul	e appe	ars in			
Bachel	lor' deg	gree (1 major) Mathematic gree (1 major) Mathematic gree (1 major) Computatio	al Physics (2009)	09)	

Module	e title				Abbreviation
Readin	g Cour	se Dynamical Systems			10-M-RCY-082-m01
Modul	e coord	linator		Module offered by	I
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
4	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	its	•			
Basics	in dyn	amical systems and nonli	near dynamics.		
Intend	ed lear	ning outcomes			
		s able to work independe use standard literature.	ntly on a given scient	ific topic. He or she	can tackle a simple mathematical
Course	<b>S</b> (type, 1	number of weekly contact hours, l	anguage — if other than Ger	man)	
A (no ii	nforma	tion on SWS (weekly cont	act hours) and cours	e language available	<u>e)</u>
		<b>sessment</b> (type, scope, langua ble for bonus)	ge — if other than German, o	examination offered — if no	ot every semester, information on whether
a) talk	(appro	x. 30 minutes) or b) writte	en elaboration (appro	x. 5 to 10 pages)	
Allocat	ion of	places			
Additio	onal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
Referre	ed to in	LPO I (examination regulation	s for teaching-degree progra	mmes)	
Module	e appea	ars in			
Bachel	or' deg	rree (1 major) Mathematic rree (1 major) Mathematic rree (1 major) Computatio	al Physics (2009)	09)	

Modul	e title				Abbreviation
Readin	ig Cour	se Optimisation			10-M-RCP-082-m01
Modul	e coord	linator		Module offered by	<u> </u>
Dean o	Dean of Studies Mathematik (Mathematics)			Institute of Mathen	natics
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
4	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conter	nts	•	•		
Basics	in opti	mization.			
Intend	ed lear	ning outcomes			
		s able to work independe use standard literature.	ntly on a given scient	ific topic. He or she	can tackle a simple mathematical
Course	<b>S</b> (type,	number of weekly contact hours,	language — if other than Ge	rman)	
A (no i	nforma	tion on SWS (weekly con	tact hours) and cours	e language available	e)
		<b>sessment</b> (type, scope, langua ble for bonus)	age — if other than German,	examination offered — if no	ot every semester, information on whether
a) talk	(appro	x. 30 minutes) or b) writt	en elaboration (appro	ox. 5 to 10 pages)	
Allocat	tion of	places			
Additio	onal inf	ormation			
	_				
Worklo	ad				
Teachi	ng cyc	e			
Referre	ed to in	LPO I (examination regulation	s for teaching-degree progra	immes)	
Modul	e appe	ars in			
Bachel	or' deg	rree (1 major) Mathematio rree (1 major) Mathematio rree (1 major) Computatio	cal Physics (2009)	09)	

Module	e title				Abbreviation	
Program	mming	course for students of I	Mathematics and othe	r subjects	10-M-PRG-082-mo	1
Module	e coord	inator		Module offered by		
Dean of	f Studi	es Mathematik (Mathem	natics)	Institute of Mathem	natics	
ECTS		od of grading	Only after succ. com			
		successfully completed				
3						
Duratio		Module level	Other prerequisites			
1 seme:	ster	undergraduate	Admission prerequis monitored, a maxim			
Conten	ts					
Basics matics.		odern programming lang	guage (e. g. C or Fortrar	n) taking into accoui	nt the particular nee	ds in mathe-
Intende	ed lear	ning outcomes				
The stu in math		able to work independers.	ently on small program	iming exercises and	standard programn	ning problems
Course	<b>S</b> (type, r	umber of weekly contact hours	language — if other than Ger	man)		
P (no in	offormat	ion on SWS (weekly cor	itact hours) and course	e language available	2)	
		<b>essment</b> (type, scope, langu le for bonus)	age — if other than German, e	examination offered — if no	ot every semester, informa	tion on whether
		form of programming ex ssessment: German, En		• •	ne course)	
Allocat	-		<u> </u>			
Additio	nal inf	ormation				
Worklo	ad					
 Teachir	ng cycl	e	_			
Referre	d to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
§ 73 (1)	5. Mat	hematik Angewandte M	athematik			
Module	-					
		ree (1 major) Mathemati	(2008)			
	-	ree (1 major) Physics (20				
	-	ree (1 major) Physics (20				
	-	ree (1 major) Physics (20	•			
	-	ree (1 major) Physics (20				
	-	ree (1 major) Technolog		ls (2009)		
	-	ree (1 major) Technolog		-		
	-	ree (1 major) Nanostruci				
	-	ree (1 major) Economath				
	-	ree (1 major) Economath	-			
	-	ree (1 major) Mathemati				
	-	-	onal Mathematics (200	09)		
Bachel	ueg					
	-	ee (1 major) Physics (20	10)	-		
Master	's degr			s (2010)		

## Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Master's degree (1 major) Technology of Functional Materials (2009) Master's degree (1 major) Functional Materials (2012) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Module	e title				Abbreviation	
Compu	terorie	nted Mathematics			10-M-COM-082-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studie	es Mathematik (Mathem	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
3	<u> </u>	successfully completed				
Duratio	·	Module level	Other prerequisites			
1 seme	ster	undergraduate	Admission prerequi	site to assessment: red, a maximum of c		
Conten	Its					
merica 10-M-A	l compi NL) and	o modern mathematical utation (e.g. Matlab) to I 10-M-LNA). Computer-I and integral calculus; v	supplement the basic based solution of prob	modules in analysis plems in linear algeb	and linear algebra	((10-M-ANA 0
Intend	ed learı	ning outcomes				
		arns the use of advance cation to solve mathema		cal software package	es, and is able to as	sess their
Course	<b>S</b> (type, n	umber of weekly contact hours,	language — if other than Ger	rman)		
V + Ü (ı	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		s <b>essment</b> (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
Assess Langua	ment o age of a	form of programming ex ffered: once a year, sum ssessment: German, En	imer semester		ne course)	
Allocat	ion of p	olaces				
Additio	onal info	ormation				
			_			
Worklo	ad					
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
		hematik Angewandte M				
	e appea	-				
	••	ree (1 major) Computer S	Science (2010)			
	-	ree (1 major) Mathemati				
	-	ree (1 major) Physics (20				
	-	ree (1 major) Physics (20				
Bachel	or' deg	ree (1 major) Physics (20	012)			
	-	ree (1 major) Physics (20				
	-	ree (1 major) Technology		-		
	-	ree (1 major) Technology				
	-	ree (1 major) Nanostruct ree (1 major) Economath		)		
Bachelor's (2009)	with 1 maj	or Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische		page 152 / 156

## Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Master's degree (1 major) Physics (2010) Master's degree (1 major) Technology of Functional Materials (2010) Master's degree (1 major) Technology of Functional Materials (2009) Master's degree (1 major) Functional Materials (2012) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Module	e title			,	Abbreviation	
Advand	ed Ser	ninar Experimental/Theo	retical Physics		11-HS-092-m01	
Module	e coord	inator		Module offered by	1	
	Managing Directors of the Institute of Applied Physics an he Institute of Theoretical Physics and Astrophysics					
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate		site to assessment: of seminar presenta	regular attendance and suc- tion.	
Conten	ts	·	·			
Current	t issue	s of Theoretical/Experime	ental Physics.			
Intend	ed lear	ning outcomes				
		have advanced knowledg ntly acquire this knowled			Theoretical Physics. They are able ation.	
Course	<b>S</b> (type, 1	number of weekly contact hours, l	anguage — if other than Ge	rman)		
S (no ir	nforma	tion on SWS (weekly cont	act hours) and cours	e language available	e)	
		S <b>essment</b> (type, scope, langua ole for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether	
Assess and wi	ment o Il be an		ten assessment will		on the method of assessment 3 ASPO (general academic and	
Allocat			-			
Additio	onal inf	ormation	-			
Worklo	ad		-			
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulation	s for teaching-degree progra	ummes)		
			• • •			
Module	e appea	ars in				
		ree (1 major) Physics (20	10)			
	-	ree (1 major) Physics (20				
	-	ree (1 major) Mathematic				
Bachel	or's de	gree (1 major, 1 minor) Ph	nysics (Minor, 2010)			

Modul	e title				Abbreviation	
Compu	Itation	al Physics			11-A1-092-m01	
Module	e coord	linator		Module offered by		
Manag and As		ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS	1	od of grading	Only after succ. cor	npl. of module(s)		
6	nume	erical grade		· · · · ·		
Duration Module level Other prere		Other prerequisites	5			
1 semester 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 anew.				
Conten	nts					
- rando - many Intendo The stu They ha solutio	om wall -partic ed lear udents ave kno on of ph	le processes and reaction ning outcomes have knowledge of two owledge of numerical st hysical problems, e.g. a	major programming la tandard methods and a lgorithms for solving n	are able to apply com umerical problems o	nputer-assisted pro	
	-	number of weekly contact hour				
Metho	d of as	rmation on SWS (weekl <b>sessment</b> (type, scope, lang ble for bonus)	·			ation on whether
Assess and wi	sment o Il be ar	nation (approx. 120 min offered: When and how nounced in due form u regulations) 2009.	often assessment will			
Allocat	tion of	places				
		of pool of general key sk	kills (ASQ): 15 places. F	laces will be allocate	ed by lot.	
Additio	onal inf	formation				
Worklo	bad					
Teachi	ng cyc	le				
Referre	ed to in	LPOI (examination regulati	ons for teaching-degree progr	ammes)		

## Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)