

Module Catalogue

for the Subject

Mathematical Physics

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

Examination regulations version: 2020 Responsible: Faculty of Mathematics and Computer Science Responsible: Faculty of Physics and Astronomy

JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record 88|b55|-|-|H|2020



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The subject is divided into

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Learning Outcomes

German contents and learning outcome available but not translated yet.

Wissenschaftliche Befähigung

- Die Absolventinnen und Absolventen sind geschult in analytischem Denken, besitzen ein stark ausgeprägtes Abstraktionsvermögen, universell einsetzbare Problemlösungskompetenz und die Fähigkeit, komplexe Zusammenhänge zu strukturieren.
- Die Absolventinnen und Absolventen sind in der Lage, sich selbständig mithilfe von, auch fremdsprachiger, Fachliteratur in aktuelle Forschungsgebiete der Mathematischen Physik einzuarbeiten.
- Die Absolventinnen und Absolventen sind in der Lage, ihre Kenntnisse, Ideen und Problemlösungen zu komplexen Sachverhalten einem Fachpublikum gegenüber verständlich zu präsentieren.
- Die Absolventinnen und Absolventen besitzen vertiefte Kenntnisse der mathematischen Grundlagen der klassischen und Quantenphysik.
- Die Absolventinnen und Absolventen besitzen die für selbstständiges wissenschaftliches Arbeiten, insbesondere für ein Promotionsstudium erforderlichen Fach- und Methodenkenntnisse, sowie Denk- und Arbeitsweisen.
- Die Absolventinnen und Absolventen kennen die Regeln guter wissenschaftlicher Praxis und sind in der Lage, sie bei umfangreichen Arbeiten zu beachten.
- Die Absolventinnen und Absolventen besitzen weiterführende Kenntnisse aktueller Gebiete der Mathematischen Physik und können sicher mit fortgeschrittenen Methoden dieser Gebiete umgehen.
- Die Absolventinnen und Absolventen besitzen vertiefte Kenntnisse und Überblick über die aktuelle Forschung in mindestens einem Teilgebiet der Mathematischen Physik.
- Die Absolventinnen und Absolventen sind in der Lage, mit internationalen Fachvertretern und -vertreterinnen auf dem aktuellen Stand der Forschung Fragestellungen der Mathematischen Physik zu diskutieren.
- Die Absolventinnen und Absolventen kennen angrenzende Gebiete der Mathematik und Physik, und erkennen interdisziplinäre Zusammenhänge.

Befähigung zur Aufnahme einer Erwerbstätigkeit

- Die Absolventinnen und Absolventen sind geschult in analytischem Denken, besitzen ein stark ausgeprägtes Abstraktionsvermögen, universell einsetzbare Problemlösungskompetenz und die Fähigkeit, komplexe Zusammenhänge zu strukturieren.
- Die Absolventinnen und Absolventen sind in der Lage, ihre Kenntnisse, Ideen und Problemlösungen zielgruppenorientiert verständlich zu formulieren und zu präsentieren.
- Die Absolventinnen und Absolventen sind in der Lage, komplexe Probleme aus anderen Gebieten zu erkennen, strukturieren und modellieren, mit mathematischen und physikalischen Methoden Lösungswege zu entwickeln und diese Ergebnisse zu interpretieren und bewerten.
- Die Absolventinnen und Absolventen besitzen ein ausgeprägtes Durchhaltevermögen bei der Lösung komplexer Probleme.
- Die Absolventinnen und Absolventen sind in der Lage, konstruktiv und zielorientiert in internationalen, interdisziplinär zusammengesetzten Teams zu arbeiten und hierbei Verantwortung zu tragen.
- Die Absolventinnen und Absolventen sind in der Lage, sich neue Wissensgebiete und aktuelle Entwicklungen selbständig, effizient und systematisch zu erschließen.
- Die Absolventinnen und Absolventen sind in der Lage, auch bei unvollständig vorliegenden Informationen mathematisch-physikalische Probleme wissenschaftlich und unter Beachtung der

Master's with 1 major Mathematical Physics (2020)

Regeln guter wissenschaftlicher Praxis selbstständig zu bearbeiten und die Ergebnisse und Folgen ihrer Arbeit darzustellen, zu bewerten und zu vertreten.

Persönlichkeitsentwicklung

UNIVERSITÄT

WÜRZBURG

- Die Absolventinnen und Absolventen sind geschult in analytischem Denken, besitzen ein stark ausgeprägtes Abstraktionsvermögen, universell einsetzbare Problemlösungskompetenz und die Fähigkeit, komplexe Zusammenhänge zu strukturieren.
- Die Absolventinnen und Absolventen sind in der Lage, in partizipativen Prozessen gestaltend mitzuwirken.
- Die Absolventinnen und Absolventen besitzen ein ausgeprägtes Durchhaltevermögen bei der Lösung komplexer Probleme.
- Die Absolventinnen und Absolventen sind in der Lage, komplexe Ideen und Lösungsvorschläge allgemeinverständlich zu formulieren und professionell zu präsentieren.

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:

ASPO2015

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

22-Jan-2020 (2020-7) 12-Jun-2024 (2024-77)

14-Nov-2024 (2024-98)

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.

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Compulsory Courses

(20 ECTS credits)

Module title				Abbreviation			
Analysis and Geometry of Classical Systems				10-M=MP1-161-m01			
Module	coord	inator		Module offered by			
Dean of	fStudie	es Mathematik (Mathen	natics)	Institute of Mathem	atics		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
10	nume	rical grade					
Duratio	n	Module level	Other prerequisites	i			
1 semes	ster	graduate					
Conten	ts						
geomet tion to o geomet ty theor Recomr Basic k	Modern analytic methods (such as partial differential equations) and geometric methods (such as differential geometry) for the description of classical physics. Examples include movements of deformable bodies as reaction to outer load (deformation of elastic bodies, flow of a fluid, stream of a gas). Additional examples include geometric mechanics and symplectic geometry, classical field theory and classical gauge theory, general relativity theory. Recommended previous knowledge: Basic knowledge from the modules "Differential Geometry", "Introduction to Topology" and "Geometric Analysis"						
		ed. Furthermore, basic					
The stu	dent ga	ains insight into modern aced techniques in this				ics. He/She	
Course	5 (type, n	umber of weekly contact hours	, language — if other than Ge	rman)			
V (4) + l Module		t in: German and/or Eng	glish				
		e ssment (type, scope, langu le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
b) oral e c) oral e	examin examin ge of a	nination (approx. 90 to ation of one candidate ation in groups (groups ssessment: German or bonus	each (approx. 20 minu of 2, 15 minutes per c	utes) or			
Allocati	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
300 h							
Teachir	ng cycl	9					
Referre	d to in	LPOI (examination regulation	ns for teaching-degree progra	ammes)			
Module	appea	rs in					
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019)							
master's Wi	птпајо	Mathematical Physics (2020)		generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 10 / 281	

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title				Abbreviation		
Algebra and Dynamics of Quantum Systems 10-M=MP2-161-r					10-M=MP2-161-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade		· · · · · ·		
Duratio		Module level	Other prerequisites			
1 seme		graduate				
Conten		51000000				
braic qu Recomu Basic k	uantun mende nowleo	raic methods for dynami n field theory, spectral th d previous knowledge: dge from the modules "Fu is recommended. Basic	eory, symmetries and unctional Analysis", "	l representation theo	ory. logy" and "Introduct	
Intende	ed lear	ning outcomes				
		ains insight into modern nced techniques in this f				ics. He/She
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	rman)		
V (4) + Module		t in: German and/or Engl	ish			
		sessment (type, scope, langua		examination offered — if no	t every semester, informati	on on whether
		le for bonus)	· · ·		· ·	
b) oral c) oral (examir examin ge of a	mination (approx. 90 to 1 nation of one candidate e nation in groups (groups o ssessment: German or E bonus	each (approx. 20 minu of 2, 15 minutes per c	utes) or		
Allocat	ion of _l	olaces				
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		LPO I (examination regulation	s for teaching-degree progra	immes)		
Module appears in						
		ee (1 major) Mathematics	5 (2016)			
	-	ee (1 major) Mathematica				
		ning degree Gymnasium				016)
		ry course MINT Teacher E		Network Bavaria (EN	B) (2016)	
	-	ee (1 major) Mathematics	-			,
		hing degree Gymnasium				020)
		ry course MINT Teacher E		Network Bavaria (EN	в) (2020)	
		ee (1 major) Mathematica r Mathematical Physics (2020)		generated 19-Apr-2025 • exa	um reg da.	page 12 / 281
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Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)



Compulsory Electives

(50 ECTS credits)



Subfield Mathematics

(8 ECTS credits)

Module title			Abbreviation			
Applied Analysis 10-M=AAA					10-M=AAAN-161-mo	01
Module	e coord	inator		Module offered by		
Dean o	fStudi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
theory particu theory Recom	of Hilbe lar FEM of ellip mende	y of functional analysis a ert spaces and Fourier an I methods), principles of tic, parabolic and hyperb d previous knowledge:	alysis, spectral theor functional analysis, f oolic partial differenti	y and quantum mech function spaces, emb al equations with me	hanics, numerical m bedding theorems, c thods from function	ethods (in ompactness,
Familia	rity wit	h the contents of the mo	dule "Functional Ana	lysis" is strongly reco	ommended.	
		ning outcomes				
to esta	blish a	acquainted with the fun connection between his, ther natural and enginee	/her acquired skills a			
Course	S (type, r	number of weekly contact hours, I	language — if other than Gei	rman)		
V (4) + Module		t in: German and/or Engl	ish			
		sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, informati	on on whether
b) oral c) oral Langua	examir examin Ige of a ment o	mination (approx. 90 to 1 nation of one candidate e ation in groups (groups o ssessment: German or E ffered: In the semester ir honus	each (approx. 20 minu of 2, 15 minutes per c nglish	utes) or andidate)	ıbsequent semester	
Allocat						
Additio	onal inf	ormation				
Worklo	ad					
300 h	-					
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	e appea	ars in				
Master	's degr	ee (1 major) Mathematics	5 (2016)			
	-	ee (1 major) Physics (201				
Master's degree (1 major) Economathematics (2016)						
	Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016)					
•	-	r Mathematical Physics (2020)			am reg da.	nare 16 / 201
Master S W	ian i majo	matrematical Flipsics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 16 / 281

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

Module title Abbreviation						
Topics in Algebra 10-M=AALG-161-m01)1		
Module coordinator Module offer			Module offered by			
Dean o	f 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	ster	graduate				
Conten	ts					
algebra Recom	n. mende nowled	v topics in algebra, for ex d previous knowledge: dge of algebra is assume bra".				·
Intend	ed lear	ning outcomes				
The stu	ident is	acquainted with fundates acquainted with fundates acquainted with fundates acquarter of the second s		methods in a contem	porary field of algeb	ora, and is ab-
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	rman)		
V (4) + Module		t in: German and/or Eng	lish			
Metho	d of ass	sessment (type, scope, langu	age — if other than German,	examination offered — if no	t every semester, informati	ion on whether
module i	s creditab	le for bonus)	_			
b) oral c) oral Langua	examir examin Ige of a ment o	mination (approx. 90 to nation of one candidate nation in groups (groups ssessment: German or E .ffered: In the semester i bonus	each (approx. 20 minu of 2, 15 minutes per c English	utes) or andidate)	bsequent semester	
Allocat	ion of _l	places				
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e	_			
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Module appears in						
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019)						
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Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation			
Differential Geometry 10-M=ADGM-161-m01					01	
Module	e coord	inator		Module offered by		
Dean o	f 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	ster	graduate				
Conten	ts		-			
folds. Recom	mende	dvanced results in differ d previous knowledge: dge from the modules "II				
metric	Analys	s" is recommended.				
Intende	ed lear	ning outcomes				
		acquainted with conce these methods and know				
Course	S (type, r	number of weekly contact hours,	language — if other than Ge	rman)		
V (4) + Module		t in: German and/or Eng	lish			
		sessment (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
b) oral c) oral Langua	examir examin Ige of a ment o	mination (approx. 90 to nation of one candidate ation in groups (groups ssessment: German or E ffered: In the semester i bonus	each (approx. 20 mini of 2, 15 minutes per c English	utes) or andidate)	ıbsequent semester	
Allocat	ion of _l	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cvcl	e				
Poforrad to in LPO L (meniation conclution factorial and any array of the second						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
 Module appears in						
		ee (1 major) Mathematic	5 (2016)			
	-	ee (1 major) Physics (20				
	-	ee (1 major) Mathematic				
	-	ee (1 major) Computatio	-	.6)		
Master	's teac	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)
		ry course MINT Teacher I				
Master's wi	ith 1 majo	r Mathematical Physics (2020)	-	• generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 20 / 281

Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Mathematical Data Science (2025)

Module title			Abbreviation			
Comple	Complex Analysis 10-M=AFTH-161-m01					
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	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	ster	graduate				
Conten	ts					
geomet ons (e. Recom	tric me g. ellip mende	y of mapping properties of thods. Structural propert otic functions). d previous knowledge: dge of the contents of the	ies of families of hold	omorphic and merom	orphic functions. Sp	pecial functi-
		ning outcomes				
The stu ticular betwee	ident is the (ge en his/l	acquainted with the fun ometric) mapping proper her acquired skills and ot	rties of holomorphic f ther branches of math	unctions. He/She is nematics and application	able to establish a c	connection
		number of weekly contact hours,	language — if other than Ge	rman)		
V (4) + Module		t in: German and/or Engl	ish			
		S essment (type, scope, langua ole for bonus)	age — if other than German,	examination offered — if no	t every semester, informat	ion on whether
b) oral c) oral Langua	examir examin Ige of a ment o	mination (approx. 90 to 1 nation of one candidate e nation in groups (groups o Issessment: German or E Iffered: In the semester ir bonus	each (approx. 20 minu of 2, 15 minutes per c nglish	utes) or andidate)	ıbsequent semester	
Allocat	ion of _l	places				
Additio	onal inf	ormation				
Worklo	ad					
300 h			-			
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
		ry course MINT Teacher E r Mathematical Physics (2020)		Network Bavaria (EN) generated 19-Apr-2025 • exa		nage 22 / 201
widster's Wi	nii 1 majo	r mathematical Physics (2020)		(120 ECTS) Mathematische P	-	page 22 / 281

Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Mathematical Data Science (2025)

Module title Abbreviation						
Geometric Structures 10-M=AGMS-161-mo1					01	
Module coordinator Module offered by						
Dean o	f Studi	es Mathematik (Mathem	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
ang co Recom	ndition mende	generalised polygons o s, classification results. d previous knowledge: lge from the modules "I	-			
Intend	ed lear	ning outcomes				
structu	re.He/	acquainted with the fu She is able to establish ractions of geometry an	a connection betweer	n these results and b	e , , ,	-
Course	S (type, r	umber of weekly contact hours	, language — if other than Gei	rman)		
V (4) + Module		t in: German and/or Eng	glish			
module is	s creditab	s essment (type, scope, langu le for bonus)			t every semester, informati	on on whether
b) oral c) oral Langua	examir examin Ige of a ment o	nination (approx. 90 to nation of one candidate ation in groups (groups ssessment: German or I ffered: In the semester i bonus	each (approx. 20 minu of 2, 15 minutes per c English	utes) or andidate)	bsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
		-				
Roforro	d to in	IPOI (ovamination regulation	ns for toaching dogroo progra	ummoc)		
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears inMaster's degree (1 major) Mathematics (2016)Master's degree (1 major) Mathematical Physics (2016)Master's degree (1 major) Computational Mathematics (2016)Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master	's degr	ee (1 major) Computatio	nal Mathematics (201	9)		
Master's w	ith 1 majo	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 24 / 281

Master's degree (1 major) Mathematics (2019)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation			
Industrial Statistics 1 10-M=AIST-161-m01					1	
Module coordinator Module offered by						
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS	1	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 seme	ster	graduate				
Conten	ts	0	1			
		meter and domain estin is, comparative analysis				irical distri-
Intende	ed lear	ning outcomes				
The stu	ident m	asters the fundamental	statistical methods fo	or industrial applicati	ions.	
Course	S (type, r	number of weekly contact hours,	 language — if other than Ge	rman)		
V (4) + Module		t in: German and/or Eng	lish			
		s essment (type, scope, langu ile for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	ion on whether
b) oral c) oral Langua	examir examin Ige of a ment o	mination (approx. 90 to nation of one candidate ation in groups (groups ssessment: German or E ffered: In the semester i bonus	each (approx. 20 minu of 2, 15 minutes per c English	utes) or andidate)	ıbsequent semester	
Allocat	ion of j	olaces				
			_			
Additio	nal inf	ormation	_			
			_			
Worklo	ad		_			
300 h						
Teachi	ng cvcl	e				
	0.7					
Referre	ed to in	LPO I (examination regulation	ns for teaching-degree progra	ammes)		
Module	e appea	ars in				
	-	ee (1 major) Mathematic				
	-	ee (1 major) Economathe				
		ee (1 major) Mathematic				
Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019)						
Master Supple	's teacl menta	ee (1 major) Mathematic hing degree Gymnasium ry course MINT Teacher E ee (1 major) Mathematic	MINT Teacher Educat Education PLUS, Elite			020)
Master's w	ith 1 majo	r Mathematical Physics (2020)		• generated 19-Apr-2025 • exa (120 ECTS) Mathematische P		page 26 / 281

Master's degree (1 major) Economathematics (2021)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

Master's degree (1 major) Economathematics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's degree (1 major) Economathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Economathematics (2025)

Module title					Abbreviation	
Lie Theory 10-M=ALTH-161-mo1					1	
Module coordinator				Module offered by		
Dean o	f Studi	es Mathematik (Mathem	natics)	Institute of Mathematics		
ECTS	Metho	od of grading	Only after succ. con	nly after succ. compl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Linear Lie groups and their Lie algebras, exponential function, structure and classification of Lie algebras, classic examples, applications, e. g. in physics and control theory. Recommended previous knowledge: Basic knowledge of the contents of the modules "Functional Analysis" and "Introduction to Topology" is recom- mended. Furthermore, basic knowledge of the contents of the module "Introduction to Differential Geometry" is useful.						
Intende	ed lear	ning outcomes				
	hese to	acquainted with the fun common problems, and				
Course	S (type, r	number of weekly contact hours,	language — if other than Ge	rman)		
V (4) + Module		t in: German and/or Eng	lish			
Method	d of ass	Sessment (type, scope, langu	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
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 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 						
creditable for bonus Allocation of places						
Additio	nal inf	ormation				
			_			
Worklo	ad					
300 h						
-	ng cycl	ρ	_			
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Module appears in Master's degree (1 major) Mathematics (2016)						
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016)						
Master's degree (1 major) Mathematical Physics (2016)						
Master's degree (1 major) Computational Mathematics (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master's wi	th 1 majo	r Mathematical Physics (2020)	-	e generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 28 / 281

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025)

UNIVERSITÄT

WÜRZBURG

Module title					Abbreviation	
Numeric of Large Systems of Equations 10-M=ANGG-161-m01					01	
Module coordinator			Module offered by			
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathem	atics	
ECTS Method of grading Only after succ. co			ompl. of module(s)			
10	nume	rical grade				
Duration Module level Other prerequisites						
1 seme	ster	graduate				
Conten	ts	<u>.</u>				
Discret	isation	of elliptic differential eq	uations, classical iter	ration methods, prec	onditioners, multigr	id methods.
Basic k and "N	nowleo umeric	d previous knowledge: dge of numerical mathem al Mathematics 2", is req nended.				
Intende	ed lear	ning outcomes				
		acquainted with the mo ient way to solve a given			stems of equations,	and knows
Course	S (type, r	number of weekly contact hours,	language — if other than Ge	rman)		
V (4) + Module		t in: German and/or Engl	ish			
		sessment (type, scope, langua		examination offered — if no	t every semester, informati	on on whether
		le for bonus)				
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus						
Allocation of places						
Additional information						
Workload						
300 h						
Teachi	ng cycl	e	-			
			-			
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Mathematics (2016)						
Master's degree (1 major) Economathematics (2016)						
Master's degree (1 major) Mathematical Physics (2016)						
Master's degree (1 major) Computational Mathematics (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master's degree (1 major) Computational Mathematics (2019)						
	-	r Mathematical Physics (2020)	JMU Würzburg •	generated 19-Apr-2025 • exa	-	page 30 / 281
			ta record Master	(120 ECTS) Mathematische Pl	nysik - 2020	

Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

UNIVERSITÄT

WÜRZBURG

Module title					Abbreviation	
Basics in Optimization 10-M=AOPT-161-m01					01	
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathematics)			natics)	Institute of Mathem	natics	
ECTS	Meth	od of grading	Only after succ. con	after succ. compl. of module(s)		
10	nume	rical grade				
Duration Module level Other prerequisites						
1 semester graduate						
Conter	nts	·				
		methods and technique ted optimization, examp				
Intend	ed lear	ning outcomes				
		nows the fundamental r lecide which method is			lge their strengths a	nd weaknes-
Course	S (type,	number of weekly contact hours	, language — if other than Ge	rman)		
V (4) + Module		it in: German and/or Eng	glish			
Metho	d of as	sessment (type, scope, lang	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
		mination (approx. 90 to				
b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus						
Allocat	tion of	places				
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cyc	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Mathematics (2016)						
Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016)						
Master's degree (1 major) Mathematical Physics (2010) Master's degree (1 major) Computational Mathematics (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
	-	ee (1 major) Computatio		9)		
	-	ee (1 major) Mathemation hing degree Gymnasium	-	ion PLUS Flite Netwo	ork Bayaria (FNR) (a	020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)						
Master's w	rith 1 majo	or Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 32 / 281

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

Master's degree (1 major) Economathematics (2022)

exchange program Mathematics (2023)

UNIVERSITÄT

WÜRZBURG

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's degree (1 major) Economathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Mathematical Data Science (2025)

Master's degree (1 major) Economathematics (2025)

Module title					Abbreviation	
Control Theory 10-M=ARTH-161-mo1					1	
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathematics) Institute of Mathematics						
ECTS	Metho	od of grading	Only after succ. compl. of module(s)			
10	nume	rical grade				
Duration Module level Other prerequisites						
1 seme	ster	graduate				
Conten	Contents					
bility, b Recomi	oasics i mende	o mathematical systems n optimal control. d previous knowledge: lge of the contents of th				ack and sta-
		ning outcomes				
The stu blish a and oth	dent is connec ner fielc	acquainted with the fur ction between these results ds of mathematics.	ults and broader theor	ries, and learns abou		
V (4) +		uniber of weekly contact hours,		inanj		
		t in: German and/or Eng	lish			
Method	d of ass	essment (type, scope, langu le for bonus)		examination offered — if no	t every semester, informati	on on whether
 a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus 						
Allocation of places						
Additional information						
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016)						
Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master's degree (1 major) Computational Mathematics (2019)						
Master's wi	ith 1 major	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 34 / 281



Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) Master's degree (1 major) Economathematics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023)

Module title					Abbreviation		
Stochastic Models of Risk Management					10-M=ASMR-161-m	01	
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathemat			atics)	Institute of Mathem	natics		
ECTS Method of grading			Only after succ. com	pl. of module(s)			
10	nume	rical grade					
Duratio		Module level	Other prerequisites				
1 semester graduate							
Contents							
res, val la, mod estimat series a risk in t	Measure theory, risk diagrams, failure mode and effects analysis, risk assessment in auditing, shortfall measu- res, value at risk, conditional value at risk, axiomatic of risk measures, modelling of interdependencies, copu- la, modelling of functional interrelations, regression models, basics in time series modelling, aggregated losses, estimates of shortfall measures, estimates of value at risk and conditional value at risk, basics in empirical time series analysis, methods of exponential smoothing, predictions and prediction domains, estimates of value at risk in time series, elementary empirical regression analysis, simulation methods.						
		ning outcomes					
The stu	dent is	acquainted with the fun	damental methods of	f stochastic risk anal	lysis.		
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	man)			
V (4) + Module		t in: German and/or Engl	ish				
Method	d of ass	essment (type, scope, langua	ge — if other than German, e	examination offered — if no	t every semester, informati	on on whether	
		le for bonus)					
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester							
credita	ble for	bonus					
Allocat	ion of p	olaces					
Additional information							
Worklo	ad						
300 h							
Teachir	ng cycl	e					
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master's degree (1 major) Mathematics (2016)							
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016)							
Master's degree (1 major) Athematical Physics (2016)							
Master's degree (1 major) Computational Mathematics (2016)							
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Master's degree (1 major) Computational Mathematics (2019)							
Master's degree (1 major) Mathematics (2019) Master's with 1 major Mathematical Physics (2020) JMU Würzburg • generated 19-Apr-2025 • exam. reg. da- page 36 / 281							
master's Wi	ui i majo	mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 36 / 281	



Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

Module	e title				Abbreviation	
Stocha	stical F	Processes			10-M=ASTP-161-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Markov	chains	s, queues, stochastic pr	ocesses in C[0,1], Brov	wnian motion, Donsk	er's theorem, projec	tive limits.
Basic k	nowled	d previous knowledge: lge of stochastics is req ıf the module "Stochast			astics 1" module. Kno	owledge of
Intende	ed lear	ning outcomes				
		acquainted with the fu cal problems.	ndamental notions an	d methods of stocha	stical processes and	l can apply
Course	S (type, r	umber of weekly contact hours	, language — if other than Ger	rman)		
V (4) + Module		t in: German and/or Enទ្	glish			
		s essment (type, scope, langu le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether
b) oral c) oral Langua Assess	examir examin Ige of a ment o	mination (approx. 90 to ation of one candidate ation in groups (groups ssessment: German or I fered: In the semester	each (approx. 20 minu of 2, 15 minutes per c English	utes) or andidate)	ibsequent semester	
credita			_			
Allocat	ion of p	Diaces				
			_			
Additio	nal inf	ormation				
Worklo	ad					
300 h			_			
Teachi	ng cycl	e				
 D - f						
		LPO I (examination regulatio	ns for teaching-degree progra	immes)		
Module	e appea	urs in				
Master	's degr	ee (1 major) Mathematio	cs (2016)			
	-	ee (1 major) Economath				
	-	ee (1 major) Mathematio	-			
	-	ee (1 major) Computatio				
		ning degree Gymnasium				016)
		y course MINT Teacher			B) (2016)	
	-	ee (1 major) Computatio		9)		
		ee (1 major) Mathematic				
waster's w	itri 1 majoi	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	_	page 38 / 281



Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

Module	title			,	Abbreviation	
Τοροίο	gy				10-M=ATOP-161-mc	01
Module	coord	inator		Module offered by		
Dean of	fStudi	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10		rical grade		•		
Duratio		Module level	Other prerequisites			
1 seme		graduate				
Conten		Sidudite	1			
					:	
spaces	, cover	opology, topological inv ing spaces.	ariants (e. g. fundam)	ental group, connect	ion), construction of	topological
Intende	ed lear	ning outcomes				
		acquainted with the fur non problems.	idamental results, the	eorems and methods	in topology and is a	ble to apply
Course	S (type, r	number of weekly contact hours,	language — if other than Ge	rman)		
V (4) + I Module		t in: German and/or Eng	lish			
Method	l of ass	sessment (type, scope, langu	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
		le for bonus)				
b) oral (c) oral (Langua	examir examin ge of a ment o	mination (approx. 90 to nation of one candidate o ation in groups (groups ssessment: German or E ffered: In the semester i bonus	each (approx. 20 minu of 2, 15 minutes per c nglish	utes) or andidate)	ıbsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h			-			
Teachir		•				
Teaciiii	ig cyci	e				
 Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	nmmes)		
Module	e appea	urs in				
	-	ee (1 major) Mathematic				
	-	ee (1 major) Physics (20:				
	-	ee (1 major) Mathematic	-			
	-	ee (1 major) Computatio				
		ning degree Gymnasium				016)
		y course MINT Teacher E			в) (2016)	
		ee (1 major) Computatio		9)		
	-	ee (1 major) Mathematic ee (1 major) Physics (20:	-			
	-	ning degree Gymnasium		ion PLUS Flite Netwo	ork Bayaria (FNR) (or	<u>)</u>
	Jicaci	ing active dynnasium				220)
Master's wi	th 1 majo	r Mathematical Physics (2020)	-	9 generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 40 / 281

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's with 1 major Mathematical Physics (2020)

Module	e title				Abbreviation	
Time S	eries A	nalysis 1			10-M=AZRA-161-mc	91
Module	e coord	inator		Module offered by		
Dean o	f Studie	es Mathematik (Mathem	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Additiv	e mode	el, linear filters, autocor	relation, moving avera	ge, autoregressive p	rocesses, Box-Jenkiı	ns method.
Basic k	nowled	d previous knowledge: lge of stochastics is req If the module "Stochast			astics 1" module. Kn	owledge of
Intende	ed learı	ning outcomes				
	dent is	acquainted with the fu	ndamental methods o	f time series analysis	and can apply then	n to practical
Course	S (type, n	umber of weekly contact hours,	 language — if other than Ger	rman)		
V (4) + Module	• •	t in: German and/or Eng	lish			
		essment (type, scope, langu le for bonus)	age — if other than German, o	examination offered — if no	t every semester, informati	on on whether
b) oral c) oral Langua	examin examin Ige of a ment o	mination (approx. 90 to ation of one candidate ation in groups (groups ssessment: German or I ffered: In the semester i bonus	each (approx. 20 minu of 2, 15 minutes per c English	utes) or andidate)	bsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cvcl	6				
	0 . 7	-				
Referre	d to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
		х с				
Module	e appea	nrs in				
Master	's degr	ee (1 major) Mathematic	rs (2016)			
Master	's degr	ee (1 major) Economath	ematics (2016)			
	-	ee (1 major) Mathematic	•			
	-	ee (1 major) Computatio				
		ning degree Gymnasium				016)
		y course MINT Teacher I			B) (2016)	
	-	ee (1 major) Computatio		9)		
	•	ee (1 major) Mathematic		concreted to Art	m roa da	page (a. / - 0.
master s W	iui i majoi	matrenialical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 42 / 281



Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)

Module	e title				Abbreviation	
Numbe	r Theoi	ŷ			10-M=AZTH-161-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
applica overvie Recom Basic k	itions to w of th mende nowled	etic functions and their o prime number distribu e development of mode d previous knowledge: lge of algebra and numl ', "Introduction to Numb	ition and diophantine rn number theory. per theory is assumed	equations; discussion, such as can be acqu	on of the Riemann hy	ypothesis,
Intende	ed lear	ning outcomes				
The stu structu	dent is res in r	acquainted with the fu number theory and know evelopments in number	s methods for the sol			•
Course	S (type, r	number of weekly contact hours	, language — if other than Gei	rman)		
V (4) + Module		t in: German and/or Enទ្	lish			
Method	d of ass	sessment (type, scope, langu	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
		le for bonus)				
b) oral c) oral e Langua	examir examin ge of a ment o	mination (approx. 90 to nation of one candidate ation in groups (groups ssessment: German or I ffered: In the semester i bonus	each (approx. 20 minu of 2, 15 minutes per c English	utes) or andidate)	ıbsequent semester	
Allocat	ion of p	olaces	_			
Additio	nal inf	ormation				
 Worklo	ad					
300 h						
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulatio	ns for teaching-degree progra	immes)		
Module	e appea	urs in				
Master Master Master Master	's degr 's degr 's degr 's teacl	ee (1 major) Mathematic ee (1 major) Physics (20 ee (1 major) Mathematic ee (1 major) Computatio ning degree Gymnasium	16) cal Physics (2016) nal Mathematics (201 MINT Teacher Educat JMU Würzburg •		ım. reg. da-	D16) page 44 / 281
				(Let e) mathematische fi		

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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

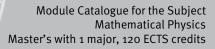
Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	title				Abbreviation	
Giovan	ni Prod	i Lecture (Master)			10-M=AGPCin-152-r	n01
Module	e coord	inator		Module offered by		
Dean of	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS		od of grading	Only after succ. con	pl. of module(s)		
5		rical grade		.p		
Duratio		Module level	Other prerequisites			
1 seme		graduate				
Conten			<u> </u>			
Introdu	ction to	o a specialised topic in r	nathematics by an int	ernational expert.		
Intende	ed lear	ning outcomes				
themat	ics. He	acquainted with the fur /She is able to establish I applications in other su	a connection betwee			
Course	S (type, r	number of weekly contact hours,	language — if other than Gei	man)		
V (3) + Module		t in: English				
Method	d of ass	sessment (type, scope, langu	age — if other than German,	examination offered — if no	t every semester, informati	ion on whether
module is	creditab	le for bonus)				
c) oral e Langua	examin ge of a ment o	ation of one candidate o ation in groups (groups ssessment: English ffered: In the semester i bonus	of 2, approx. 10 minu	tes per candidate)	ubsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
	au					
150 h			_			
Teachir	ig cycl	e				
			_			
Referre	d to in	LPO I (examination regulation	ns for teaching-degree progra	mmes)		
Module	e appea	irs in				
Master	's degr	ee (1 major) Mathematic	s International (2015)			
	-	ee (1 major) Mathematic				
	-	ee (1 major) Mathematic				
	-	ee (1 major) Computatio				
	-	ee (1 major) Computatio		9)		
	-	ee (1 major) Mathematic	-			
	-	ee (1 major) Mathematic ee (1 major) Mathematic	-			
	-	ee (1 major) Mathematic ee (1 major) Computatio		2)		
	-	ee (1 major) Computatio ee (1 major) Mathematic		<i>∠</i>)		
	Jucgh	ee (I major) mathematic				
Master's wi	th 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 46 / 281



Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Mathematics International (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Mathematics International (2025) Master's degree (1 major) Mathematical Data Science (2025)

Module	e title				Abbreviation	
Selecte	ed Topi	cs in Analysis			10-M=VANA-161-m)1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts		•			
with ot Recom Depend	her ma mende ding on	ussion of a specialised to thematical concepts. d previous knowledge: the content, basic and a commended to consult th	advanced knowledge			
Intend	ed lear	ning outcomes				
The stu comple		acquainted with advand lems.	ed results in a select	ed topic in analysis,	and is able to apply	these to
Course	S (type, r	number of weekly contact hours,	language — if other than Gei	rman)		
V (4) + Module		t in: German and/or Eng	lish			
Metho	d of ass	sessment (type, scope, langua	age — if other than German,	examination offered — if no	t every semester, informati	ion on whether
		le for bonus)				
b) oral c) oral Langua	examir examin Ige of a ment o	mination (approx. 90 to a nation of one candidate e ation in groups (groups ssessment: German or E ffered: In the semester in bonus	each (approx. 20 minu of 2, 15 minutes per c nglish	utes) or andidate)	bsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
	3 0,00	-				
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
Module						
Master Master Master Supple Master Master	's degr 's degr 's teach mentar 's degr 's degr	ee (1 major) Mathematic: ee (1 major) Mathematic: ee (1 major) Computation ning degree Gymnasium y course MINT Teacher E ee (1 major) Computation ee (1 major) Mathematic:	al Physics (2016) nal Mathematics (201 MINT Teacher Educat ducation PLUS, Elite nal Mathematics (201 s (2019)	ion PLUS, Elite Netwo Network Bavaria (ENI 9)	3) (2016)	
Master's w	ith 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 48 / 281

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Mathematical Data Science (2025)

Module	e title				Abbreviation	
Algebra	aic Top	ology			10-M=VATP-161-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	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	ster	graduate				
Conten	ts		l			
Homolo spaces		motopy invariance, exac	t sequences, cohomo	logy, application to t	he topology of Eucli	dean
		d previous knowledge: Ige of topology is assum	ed, such as can be ac	quired in the modul	e "Introduction to To	pology".
Intende	ed lear	ning outcomes				
The stu	dent is	acquainted with advance	ed results in algebra	ic topology.		
		number of weekly contact hours,				
V (4) +	Ü (2)	t in: German and/or Engl				
Method	d of ass	s essment (type, scope, langua le for bonus)		examination offered — if no	t every semester, informati	on on whether
b) oral c) oral (Langua	examir examin Ige of a ment o	mination (approx. 90 to a nation of one candidate e ation in groups (groups o ssessment: German or E ffered: In the semester ir bonus	each (approx. 20 minu of 2, 15 minutes per c nglish	utes) or andidate)	bsequent semester	
Allocat	ion of _l	olaces				
 Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cvcl	e	-			
		-				
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
Referre				inines)		
Module	e appea	ars in				
		ee (1 major) Mathematics	5 (2016)			
	-	ee (1 major) Mathematica				
	-	hing degree Gymnasium	•	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)
Supple	menta	ry course MINT Teacher E	ducation PLUS, Elite	Network Bavaria (ENI	3) (2016)	
	-	ee (1 major) Mathematics	-			
		hing degree Gymnasium				020)
		ry course MINT Teacher E		Network Bavaria (ENI	3) (2020)	
	-	ee (1 major) Mathematica	•			
		ee (1 major) Computatior				
Master's wi	ith 1 majo	r Mathematical Physics (2020)		generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl		page 50 / 281

Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	e title				Abbreviation	
Groups	and th	eir Representations			10-M=VGDS-161-m	01
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathen	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites	i		
1 seme	ster	graduate				
Conten	ts					
the S-ri Recom	ngs of mende nowled	d previous knowledge: Ige of algebra is assum				
Intende	ed lear	ning outcomes				
		asters advanced algeb questions in group theo				
Course	S (type, r	number of weekly contact hours	, language — if other than Ge	rman)		
V (4) + Module		t in: German and/or Eng	glish			
		sessment (type, scope, langu le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
b) oral c) oral (Langua	examir examin ge of a ment o	mination (approx. 90 to nation of one candidate ation in groups (groups ssessment: German or ffered: In the semester bonus	each (approx. 20 minu of 2, 15 minutes per c English	utes) or andidate)	ibsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	ammes)		
Module	e appea	ars in				
Master Master Master Master Supple	's degr 's degr 's degr 's teach mentai	ee (1 major) Mathematic ee (1 major) Physics (20 ee (1 major) Mathematic ee (1 major) Computatic ning degree Gymnasium y course MINT Teacher	16) cal Physics (2016) onal Mathematics (201 n MINT Teacher Educat Education PLUS, Elite	ion PLUS, Elite Netwo	8) (2016)	D16)
master S WI	an i majo	mathematical Flipsics (2020)	· · · · · · · · · · · · · · · · · · ·	(120 ECTS) Mathematische Pl	•	page 52 / 201

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Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Mathematical Data Science (2025)

Module	title				Abbreviation	
Geome	trical N	Nechanics			10-M=VGEM-161-m	01
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathen	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts		-			
tic geor phase s Recom Advanc Geome	metry, o space r mende ed kno try". Kr	uilds on the topics cove cotangent bundles and reduction, normal forms d previous knowledge: wledge of differential g owledge of the content cal mechanics can also	other examples of sym , introduction to Poiss eometry is required, su s of the module "Introd	plectic manifolds, sy on geometry. uch as can be acquire	ymmetries and Noetl ed in the module "Di	her theorem, ifferential
		ning outcomes				
The stu He/She	dent is e is able	acquainted with select e to establish a connect s in physics.				
Course	S (type, r	number of weekly contact hours	, language — if other than Ger	man)		
V (4) + Module		t in: German and/or Eng	glish			
		sessment (type, scope, lang le for bonus)	uage — if other than German, e	examination offered — if no	t every semester, informati	on on whether
b) oral c) oral e Langua	examir examin ge of a ment o	mination (approx. 90 to nation of one candidate ation in groups (groups ssessment: German or ffered: In the semester bonus	each (approx. 20 minu of 2, 15 minutes per c English	ites) or andidate)	bsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachir	ıg cycl	e				
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)		
Module	e appea	ars in				
Master Master Master Master	's degr 's degr 's degr 's teacl	ee (1 major) Mathemati ee (1 major) Physics (20 ee (1 major) Mathemati ning degree Gymnasium	16) cal Physics (2016) n MINT Teacher Educati			
Master's wi	th 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 54 / 281

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	e title				Abbreviation	
Industr	ial Sta	tistics 2			10-M=VIST-161-mo:	1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10		rical grade		•		
Duratio		Module level	Other prerequisites	i		
1 seme		graduate				
Conten		Siddate				
Linear i ling, ba mains,	models isics in statist	s, regression analysis, no empirical time series ar ical process monitoring.				
Intende	ed lear	ning outcomes	-			
The stu	dent m	asters advanced statist	ical methods for indu	strial applications.		
Course	S (type, r	number of weekly contact hours,	language — if other than Ge	rman)		
V (4) + Module		t in: German and/or Eng	lish			
		sessment (type, scope, langu ile for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	ion on whether
Langua	ge of a ment o	ation in groups (groups ssessment: German or E ffered: In the semester i bonus	English		ubsequent semester	
Allocat	ion of _l	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
	<u> </u>					
Referre	d to in	LPO I (examination regulation		ammec)		
				inities)		
Module	e appea	ars in				
Master	's degr	ee (1 major) Mathematic				
	-	ee (1 major) Economathe ee (1 major) Mathematic				
	-	ee (1 major) Computatio	•	6)		
Master Supple Master	's teacl mentai 's degr	hing degree Gymnasium ry course MINT Teacher E ee (1 major) Computatio ee (1 major) Mathematic	MINT Teacher Educat Education PLUS, Elite nal Mathematics (201	ion PLUS, Elite Netwo Network Bavaria (EN		016)
Master	's teacl	hing degree Gymnasium ry course MINT Teacher E	MINT Teacher Educat			020)
Master's wi	ith 1 majo	r Mathematical Physics (2020)	-	• generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 56 / 281

Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Economathematics (2025)

Module	e title				Abbreviation	
Field A	rithme	tics			10-M=VKAR-161-mo	91
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites	;		
1 seme	ster	graduate				
Conten	ts					
ber the ture) ar Recomi	ory, e. nd the i mende nowled	of Galois theory, group t g. topics around Hilbert inverse problem in Galo d previous knowledge: dge of algebra is assume bra".	's irreducibility theore is theory.	m, permutation poly	nomials (e. g. Calitz-	Wan-conjec-
Intende	ed lear	ning outcomes				
The stu	dent m	asters advanced algebr questions in algebra and				n contempo-
Course	S (type, r	number of weekly contact hours	, language — if other than Ge	rman)		
V (4) + Module		t in: German and/or Eng	glish			
		sessment (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
b) oral c) oral (Langua	examir examin Ige of a ment o	mination (approx. 90 to nation of one candidate ation in groups (groups ssessment: German or I ffered: In the semester bonus	each (approx. 20 mini of 2, 15 minutes per c English	utes) or andidate)	ıbsequent semester	
Allocat	ion of _l	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h	-					
Teachiı	ng cycl	e				
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	ammes)		
Module	e appea	ars in				
Master Master Supple Master Master	's degr 's teacl mentar 's degr 's teacl	ee (1 major) Mathematic ee (1 major) Mathematic hing degree Gymnasium ry course MINT Teacher ee (1 major) Mathematic hing degree Gymnasium	cal Physics (2016) MINT Teacher Educat Education PLUS, Elite (2019) MINT Teacher Educat	Network Bavaria (EN	B) (2016) ork Bavaria (ENB) (20	
master S WI	iui i illajo	i matieniaticai Fliysics (2020)	-	(120 ECTS) Mathematische P	-	page 50 / 201

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's with 1 major Mathematical Physics (2020)

	e title				Abbreviation	
Numer	ic of Pa	rtial Differential Equat	ions		10-M=VNPE-161-mc	01
Modul	e coord	inator		Module offered by		
Dean c	of Studi	es Mathematik (Mather	matics)	Institute of Mathem	atics	
ECTS	1	od of grading	Only after succ. con	npl. of module(s)		
10		rical grade				
Duratio		Module level	Other prerequisites	•		
		graduate		•		
1 seme		glauuale				
(nume discon Recom We rec	rical me tinuous mende ommer	al differential equation: ethods for elliptic, para 5 Gelerkin finite elemen d previous knowledge: nd basic knowledge of f	bolic and hyperbolic parts method, finite differ	artial differential equ rences and finite volu I partial differential e	ations; finite elemen ime methods). quations, such as ca	nts method,
		dules "Introduction to F	unctional Analysis an	a Applied Analysis	•	
		ning outcomes				
		acquainted with adva			ential equations.	
		number of weekly contact hour	s, language — if other than Ge	rman)		
V (4) + Modul		t in: German and/or En	glish			
		s essment (type, scope, lang ole for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
c) oral Langua Assess	examin age of a	nation of one candidate nation in groups (groups ssessment: German or ffered: In the semester bonus	s of 2, 15 minutes per c English	candidate)	ubsequent semester	
Allocat	tion of _l	places				
 Additio	onal inf	ormation				
 Additio	onal inf	ormation				
 Additio Worklo		ormation				
 Workla		ormation				
 Worklo 300 h	oad					
 Worklo 300 h						
 Worklo 300 h Teachi 	oad ng cycl	e				
 Worklo 300 h Teachi 	oad ng cycl		ons for teaching-degree progra	ammes)		
 Workla 300 h Teachi Referra	ng cycl ed to in	e LPO I (examination regulati	ons for teaching-degree progra	ammes)		
 Worklo 300 h Teachi Referro Modulo	oad ng cycl ed to in e appea	e LPOI (examination regulati ars in		ammes)		
 300 h Teachi Referre Master Master Master Master Master Master Master	ed to in e appea f's degr f's degr f's degr f's degr f's degr f's degr f's degr	e LPO I (examination regulati ars in ee (1 major) Mathemati ee (1 major) Physics (20 ee (1 major) Economath ee (1 major) Mathemati ee (1 major) Computation hing degree Gymnasiur	cs (2016) D16) nematics (2016) Ical Physics (2016) Onal Mathematics (201 n MINT Teacher Educat	16) tion PLUS, Elite Netw		016)
 Worklo 300 h Teachi Referro Modulo Master Master Master Master Master Supple	ed to in ed to in e appea f's degr f's degr f's degr f's degr f's degr f's teact ementa	e LPOI (examination regulati ars in ee (1 major) Mathemati ee (1 major) Physics (20 ee (1 major) Economath ee (1 major) Mathemati ee (1 major) Computatio	cs (2016) 016) nematics (2016) cal Physics (2016) onal Mathematics (201 n MINT Teacher Educat Education PLUS, Elite	16) tion PLUS, Elite Netw	B) (2016)	016)

Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

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Module title					Abbreviation			
Selected Topics in Optimization 10-M=VOPT-161-mo1						01		
Module coordinator M				Module offered by	<u> </u>			
Dean of Studies Mathematik (Mathema			natics)	Institute of Mathem	atics			
				Only after succ. compl. of module(s)				
10		rical grade						
Duratio		Module level	Other prerequisites					
1 seme	ster	graduate						
Conten	ts							
		s in optimization, e.g. i timization with different		semidefinite program	ns, non-smooth optin	mization, ga-		
Intende	ed lear	ning outcomes						
The stu	dent is	acquainted with advan research questions in c			He gains the ability t	o work on		
Course	S (type, r	number of weekly contact hours	, language — if other than Ger	rman)				
V (4) + Module		t in: German and/or Eng	glish					
Metho	d of ass	sessment (type, scope, langu	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether		
		le for bonus)						
c) oral Langua	examin Ige of a ment o	ation of one candidate ation in groups (groups ssessment: German or I ffered: In the semester bonus	of 2, 15 minutes per c English	andidate)	ubsequent semester			
Allocat	ion of _l	olaces						
Additio	nal inf	ormation						
Worklo	ad							
300 h								
Teachi								
Teacini	ig tyti	e						
Referre	d to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)				
Module	e appea	irs in						
Master's degree (1 major) Mathematics (2016)								
Master's degree (1 major) Economathematics (2016)								
Master's degree (1 major) Mathematical Physics (2016)								
Master's degree (1 major) Computational Mathematics (2016)								
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)								
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)								
Master's degree (1 major) Computational Mathematics (2019)								
Master's degree (1 major) Mathematics (2019) Master's teaching degree Gympacium MINT Teacher Education PLUS, Elite Network Bayaria (ENB) (2020)								
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)								
Master's w	ith 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 62 / 281		

Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025)

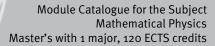
Module title Abbreviation								
Statistical Analysis 10-M=VSTA-161-m01								
Module coordinator				Module offered by	Aodule offered by			
Dean of Studies Mathematik (Mathema			atics)	Institute of Mathem	atics			
ECTS Method of grading			Only after succ. con	Only after succ. compl. of module(s)				
10	nume	rical grade						
Duratio	on	Module level	Other prerequisites					
1 seme	ster	graduate						
Conten	Contents							
crimina Recom Basic k	mende	ables, categorical regres ction analysis, cluster an d previous knowledge: lge of stochastics is requ of the module "Stochasti	alysis, principal comp lired, such as that acc	oonent analysis, fact quired in the "Stocha	or analysis.			
Intend	ed lear	ning outcomes						
The stu proble		acquainted with the fun	damental methods ir	n statistical analysis	and can apply them	to practical		
Course	S (type, r	number of weekly contact hours,	language — if other than Gei	rman)				
V (4) + Module		t in: German and/or Eng	lish					
Metho	d of ass	sessment (type, scope, langua	age — if other than German,	examination offered — if no	t every semester, informati	on on whether		
		le for bonus)			· ·			
b) oral c) oral Langua Assess	 a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus 							
Allocat	ion of _l	olaces						
Additio	onal inf	ormation						
			-					
Worklo	ad							
300 h								
Teachi	ng cycl	e						
			-					
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module	e appea	nrs in						
Master's degree (1 major) Mathematics (2016)								
	-	ee (1 major) Economathe						
Master's degree (1 major) Mathematical Physics (2016)								
Master's degree (1 major) Computational Mathematics (2016)								
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)								
Master's degree (1 major) Computational Mathematics (2019)								
	-	r Mathematical Physics (2020)		generated 19-Apr-2025 • exa	ım. reg. da-	page 64 / 281		
			ta record Master	(120 ECTS) Mathematische Pl	hysik - 2020			

Master's degree (1 major) Mathematics (2019)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)

Module title					Abbreviation	
Time Series Analysis 2 10-M=VZRA-161-m01						
Module coordinator				Module offered by		
			atics)			
Dean of Studies Mathematik (Mathematics) Institute of Mathematics						
ECTS	1	od of grading	Only after succ. con	npl. of module(s)		
10		rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	graduate				
Conten	nts					
	space n ce funct	odels, Kalman filter, free ions.	quency spaces, Fourie	er analysis, periodog	rams, characterisati	on of autoco-
Intend	ed lear	ning outcomes				
The stu	udent is	acquainted with advance earch questions in this f		series analysis. He ga	ains the ability to wo	ork on con-
Course	S (type, 1	number of weekly contact hours,	language — if other than Ge	rman)		
V (4) + Module		t in: German and/or Eng	lish			
		sessment (type, scope, langua		examination offered — if no	t every semester, informat	ion on whether
		le for bonus)			it every semester, monitat	ion on whether
c) oral Langua Assess	examir age of a	nation of one candidate e ation in groups (groups ssessment: German or E ffered: In the semester in bonus	of 2, 15 minutes per c nglish	andidate)	ıbsequent semester	
Allocat	tion of	olaces				
Additio	onal inf	ormation				
Worklo						
300 h						
Teachi	ng cycl	е				
			_			
Referre	ed to in	LPO I (examination regulation	ns for teaching-degree progra	ammes)		
Module	e appea	ars in				
		ee (1 major) Mathematic	s (2016)			
Master's degree (1 major) Economathematics (2016)						
Master's degree (1 major) Mathematical Physics (2016)						
Master's degree (1 major) Computational Mathematics (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master's degree (1 major) Computational Mathematics (2019)						
Master's degree (1 major) Mathematics (2019)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)						
Master's w	ith 1 majo	r Mathematical Physics (2020)		generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 66 / 281





Master's degree (1 major) Mathematical Physics (2020)

Module title				Abbreviation				
Discrete Mathematics 10-M=VDIM-161-m01					01			
Module coordinator			Module offered by					
Dean of Studies Mathematik (Mathema			atics)	Institute of Mathem	atics			
ECTS Method of grading			Only after succ. compl. of module(s)					
5	nume	rical grade						
Duratio	n	Module level	Other prerequisites					
1 seme	ster	graduate						
Conten	Contents							
graph t	heory o	thods and results in a sel or combinatorics) d previous knowledge:	lected field of discret	e mathematics (e. g.	coding theory, crypt	ography,		
		dge of the contents of the	e module "Introductio	n to Discrete Mather	natics" is required.			
Intende	ed lear	ning outcomes						
		acquainted with advance	ed results in a select	ed topic in discrete r	nathematics.			
		number of weekly contact hours, I		•				
V (3) +	Ü (1)	t in: German and/or Engl						
Method	d of ass	Sessment (type, scope, langua ole for bonus)		examination offered — if no	t every semester, informati	on on whether		
c) oral Langua	examin ge of a ment o	nation of one candidate e nation in groups (groups o ssessment: German or E ffered: In the semester ir bonus	of 2, approx. 10 minu nglish	tes per candidate)	bsequent semester			
Allocat	ion of _l	places						
Additio	nal inf	ormation						
Worklo	ad							
150 h								
Teachi	ng cycl	e						
Referred to in LPO I (examination regulations for teaching-degree programmes)								
Module	e appea	ars in						
Master's degree (1 major) Mathematics (2016)								
Master's degree (1 major) Physics (2016)								
Master's degree (1 major) Nanostructure Technology (2016)								
	-	ee (1 major) Economathe						
Master's degree (1 major) Mathematical Physics (2016)								
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)								
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)								
Master's degree (1 major) Mathematics (2019)								
Master's degree (1 major) Nanostructure Technology (2020) Master's with 1 major Mathematical Physics (2020) JMU Würzburg • generated 19-Apr-2025 • exam. reg. da-								
masiel S W	ini i majo	i mathematical FilySits (2020)		(120 ECTS) Mathematische Pl		page 68 / 281		

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Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

Module title				Abbreviation		
Dynamical Systems 10-M=VDSY-161-m01						
Module coordinator			Module offered by			
Dean of Studies Mathematik (Mathemat		atics)	Institute of Mathem	atics		
ECTS Method of grading		Only after succ. con	Only after succ. compl. of module(s)			
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Fundan	nentals	of dynamical systems,	e.g. stability theory, e	ergodic theory, Hamil	tonian systems.	
		d previous knowledge: lge of the contents of th	e module "Ordinary D	ifferential Equations'	' is useful.	
		ning outcomes	,	•		
	dent m	asters the mathematica	l methods in the theo	ry of dynamic system	ns, and is able to ana	alyse their
		number of weekly contact hours,	 language — if other than Ge	rman)		
V (3) +	Ü (1)	t in: German and/or Eng				
Method	d of ass	sessment (type, scope, langu le for bonus)		examination offered — if no	t every semester, informati	on on whether
c) oral e Langua	examin ge of a ment o	nation of one candidate ation in groups (groups ssessment: German or E ffered: In the semester i bonus	of 2, approx. 10 minu Inglish	tes per candidate)	bsequent semester	
Allocat	ion of _l	olaces				
Additio	nal inf	ormation				
Worklo	ad					
150 h						
Teachir	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Mathematics (2016)						
Master's degree (1 major) Economathematics (2016)						
Master's degree (1 major) Mathematical Physics (2016)						
Master's degree (1 major) Computational Mathematics (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)						
	Master's with 1 major Mathematical Physics (2020) JMU Würzburg • generated 19-Apr-2025 • exam. reg. da- page 70 / 281					
			-	(120 ECTS) Mathematische Pl	-	

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

Master's degree (1 major) Economathematics (2022)

exchange program Mathematics (2023)

UNIVERSITÄT

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Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's degree (1 major) Economathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Mathematical Data Science (2025)

Master's degree (1 major) Economathematics (2025)

Module title				Abbreviation			
Aspects of Geometry 10-M=VGEO-161-m01							
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathematics		atics)	Institute of Mathem	atics			
ECTS Method of grading Only after su			Only after succ. con	ıpl. of module(s)			
5	nume	rical grade					
Duration Module level Other prerequisites							
1 seme	ster	graduate					
Conten	Contents						
with ot	her ma	ission of a special type o thematical structures, e. d previous knowledge:				rrelations	
Basic k	nowled	lge from the modules "Di	ifferential Geometry"	and "Introduction to	Topology" is recomm	mended.	
Intend	ed learı	ning outcomes					
	ıdent is ex prob	acquainted with advanc lems.	ed results in a select	ed field of geometry	and can apply his/h	er skills to	
Course	S (type, n	umber of weekly contact hours, I	language — if other than Gei	man)			
V (3) + Module	• •	t in: German and/or Engl	ish				
		essment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, informati	on on whether	
c) oral Langua Assess	examin ige of a	ation of one candidate e ation in groups (groups o ssessment: German or E ffered: In the semester ir	of 2, approx. 10 minu nglish	tes per candidate)	bsequent semester		
Allocat		Jaces					
Additio	onal info	ormation					
Worklo	ad						
150 h							
Teachi	ng cycl	e					
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016)							
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Master's degree (1 major) Mathematics (2019)							
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
Master's degree (1 major) Mathematical Physics (2020)							
Master's w	ith 1 majoi	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Ph	_	page 72 / 281	

Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	Module title				Abbreviation	
Mather	natical	Continuum Mechanics			10-M=VKOM-161-m	01
Module	e coord	inator		Module offered by		
Dean of	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts		•			
Partial differential equations and/or variational methods in the context of continuum mechanics.						
Basic k	nowled	d previous knowledge: lge from the modules "O recommended, as well a			duction to Partial Dif	ferential
Intende	ed lear	ning outcomes				
The stu	dent m	asters the mathematica application.	l methods in mathem	atical continuum me	chanics and knows	about their
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	rman)		
V (3) + Module	• •	t in: German and/or Eng	lish			
		sessment (type, scope, langua le for bonus)	age — if other than German, o	examination offered — if no	t every semester, informati	on on whether
 a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus 						
Allocat						
Additio	nal inf	ormation	-			
Additio						
Worklo	ad					
150 h	au					
Teachir	ig tyti	e				
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
				inines)		
Module	e appea	ars in				
		ee (1 major) Mathematic	s (2016)			
	-	ee (1 major) Mathematic				
	-	ee (1 major) Computation		6)		
Master	's teac	hing degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)
Supple	menta	ry course MINT Teacher E	ducation PLUS, Elite I	Network Bavaria (ENI	B) (2016)	
Master	's degr	ee (1 major) Computatio	nal Mathematics (201	9)		
Master	's degr	ee (1 major) Mathematic	s (2019)			
		ning degree Gymnasium				i
Master's wi	th 1 majo	r Mathematical Physics (2020)		generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl		page 74 / 281

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	Module title Abbreviation						
Mather	matical	Imaging			10-M=VMBV-161-m	01	
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mather	natics)	Institute of Mathematics			
ECTS	Metho	od of grading	Only after succ. con	ompl. of module(s)			
5	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
Mathematical fundamentals of image processing and computer vision such as elementary projective geometry, camera models and camera calibration, rigid and non-rigid registration, reconstruction of 3D objects from camera pictures; algorithms; module might also include an introduction to geometric methods and tomography. Recommended previous knowledge: Basic knowledge of functional analysis, such as that taught in the module "Functional Analysis", is recommended							
ded.							
		ning outcomes					
The stu fields o		asters the mathematic cation.	al methods in the theo	ry of image processi	ng and knows about	their main	
Course	S (type, r	number of weekly contact hours	, language — if other than Gei	rman)			
V (3) + Ü (1) Module taught in: German and/or English							
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether							
		le for bonus)					
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus							
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
150 h							
Teachi	ng cycl	e					
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)			
Module	e appea	urs in					
		ee (1 major) Mathemati	cs (2016)				
	-	ee (1 major) Mathemati					
	-	ee (1 major) Computatio	•	6)			
		ning degree Gymnasiun				016)	
		ry course MINT Teacher			B) (2016)		
		ee (1 major) Computatio					
Master's wi	ith 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 76 / 281	

Master's degree (1 major) Mathematics (2019)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	e title				Abbreviation	
Selecte	Selected Topics in Mathematical Physics				10-M=VMPH-161-m	01
Module	a coord	inator		Module offered by		
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathem		
					latics	
ECTS	1	od of grading	Only after succ. com	ipi. of module(s)		
10	·	rical grade	-			
Duratio		Module level	Other prerequisites			
1 seme		graduate				
Conten	ts					
terial s Recom	ciences mende	s in mathematical physi , geometric field theory, d previous knowledge: the content, basic and a	advanced topics in q	uantum theory.		
		commended to consult th		nom amercint areas	or analysis is require	
Intend	ed learı	ning outcomes				
		acquainted with an adv tween his/her acquired				
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	man)		
V (4) + Module	• •	t in: German and/or Engl	ish			
Metho	d of ass	essment (type, scope, langua	age — if other than German, e	examination offered — if no	ot every semester, informat	ion on whether
		le for bonus)				
b) oral c) oral Langua	examin examin Ige of a ment o	nination (approx. 90 to a ation of one candidate e ation in groups (groups o ssessment: German or E ffered: In the semester ir bonus	each (approx. 20 minu of 2, 15 minutes per c nglish	ites) or andidate)	ubsequent semester	
Allocat	ion of p	olaces				
Additio	onal info	ormation				
Worklo	ad					
300 h						
Teachi		۵				
reacin	is cycl					
Referre	ed to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
Module	e appea	in				
Master	's degr	ee (1 major) Mathematics	5 (2016)			
	-	ee (1 major) Physics (201				
	-	ee (1 major) Mathematica	•			
Master	's teach	ee (1 major) Computatior ning degree Gymnasium y course MINT Teacher E	MINT Teacher Educati	ion PLUS, Elite Netwo		016)
		ee (1 major) Computatior			, *,	
	-	Mathematical Physics (2020)	JMU Würzburg •	generated 19-Apr-2025 • exa	-	page 78 / 281
			ta record Master	(120 ECTS) Mathematische P	hysik - 2020	

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's with 1 major Mathematical Physics (2020)

Module	Module title				Abbreviation	
Selecte	Selected Topics in Control Theory				10-M=VTRT-161-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Selected topics in linear and non-linear control theory, e.g. networked linear control systems, controllability of bilinear systems.						
		d previous knowledge: the contents of the mod	ule "Mathematical Co	ntrol Theory" or "Cor	ntrol Theory" is reaui	red.
		ning outcomes				
The stu	dent g	ains insight into contem this field and can apply			/. He/She masters a	dvanced
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	man)		
V (4) + Module		t in: German and/or Eng	lish			
		sessment (type, scope, langua le for bonus)	age — if other than German, o	examination offered — if no	t every semester, informati	on on whether
 a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus 						
Allocat	ion of I	olaces	-			
Additio	nal inf	ormation				
Additio	inat init					
Worklo	ad					
300 h						
Teachi	ng cycl	e				
	0 .)	-				
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
				,		
Module	e appea	ars in				
		ee (1 major) Mathematic	s (2016)			
	-	ee (1 major) Economathe				
	-	ee (1 major) Mathematic				
Master	's degr	ee (1 major) Computation	nal Mathematics (201	6)		
		ning degree Gymnasium				016)
		y course MINT Teacher E			B) (2016)	
	-	ee (1 major) Computation		9)		
	-	ee (1 major) Mathematic				
Master's wi	ith 1 majo	r Mathematical Physics (2020)		generated 19-Apr-2025 • exa (120 ECTS) Mathematische P		page 80 / 281



Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) Master's degree (1 major) Economathematics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023)

Module title Abbreviation							
Inverse	Probl	ems			10-M=VIPR-161-m01		
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathematics			
ECTS	Meth	od of grading	Only after succ. con	. compl. of module(s)			
5	nume	rical grade		· · · · · · · · · · · · · · · · · · ·			
Duratio	•	Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
sation Recom Basic k ded.							
Intende	ed lear	ning outcomes					
The student can judge whether a given problem is well posed or ill posed. He/She can apply regularisation me- thods and examine them regarding stability and convergence, and is familiar with selected inverse problems.							
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	rman)			
V (3) + Ü (1) Module taught in: German and/or English							
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether							
module is	creditab	le for bonus)					
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus							
Allocat	ion of _l	olaces					
Additio	nal inf	ormation					
			-				
Worklo	ad						
150 h							
Teachi	ng cycl	e					
Referre	ed to in	LPO I (examination regulation	s for teaching-degree progra	mmes)			
Module							
Master Master Master Master	Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
		ee (1 major) Computatior			· · · ·/		
	-	r Mathematical Physics (2020)	JMU Würzburg •	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pł	-	page 82 / 281	

Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021)

Module	Module title				Abbreviation		
Module	e Theor	у			10-M=VMTH-161-mo:	1	
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics		
ECTS	Metho	od of grading	Only after succ. con	1			
5		rical grade		•			
Duratio		Module level	Other prerequisites				
1 seme		graduate					
Conten		Sidduite	<u> </u>				
Basics in module theory: modules and module spaces, canonical decomposition and representations, simple, semi-simple and complex modules, module trees and their defibrations, distorsion theorems, reduction theo- rems. Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".							
		ning outcomes					
		asters mathematical me	thods in module the	ny and is able to ana	lyse their quality		
				•	ityse then quality.		
Courses (type, number of weekly contact hours, language – if other than German) V (3) + Ü (1) Module taught in: German and/or English							
		sessment (type, scope, langua		examination offered — if no	t every semester, information	n on whether	
		le for bonus)	· · · ·		· ·		
b) oral c) oral (Langua Assess	 a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus 						
Allocat	ion of j	olaces					
Additio	nal inf	ormation					
Worklo	ad						
150 h							
Teachi	ng cvcl	e					
	0 .)	2					
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)			
	<u>u co m</u>						
Module	20002	ors in					
			(2016)				
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
		y course MINT Teacher E Mathematical Physics (2020)		generated 19-Apr-2025 • exa		page 84 / 281	
				(120 ECTS) Mathematische Pl		, -3- 54 / 201	

Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	Module title				Abbreviation	
Non-lin	Non-linear Analysis				10-M=VNAN-161-m	01
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Methods in nonlinear analysis (e.g. topological methods, monotony and variational methods) with applications.						
We rec	ommen	d previous knowledge: Id basic knowledge of fu Jules "Introduction to Fu				an be acqui-
Intende	ed lear	ning outcomes				
The stu	dent is	acquainted with the co ical problems.	ncepts of non-linear a	nalysis, can compare	e them and assess tl	heir applica-
Course	S (type, r	umber of weekly contact hours	, language — if other than Gei	rman)		
V (3) + Module	• •	t in: German and/or Enន្	lish			
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. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus						
Allocat						
Additio	nal inf	ormation				
Worklo	ad					
150 h			_			
Teachi		0				
reaciiii	ig cycl	5				
Roforro	d to in	LPO I (examination regulatio	ns for toaching dogroo progra	immoc)		
				inities)		
Module	e appea	irs in				
Master	's degr	ee (1 major) Mathematio	cs (2016)			
	-	ee (1 major) Economath				
	-	ee (1 major) Mathematio				
	-	ee (1 major) Computatio				
		ning degree Gymnasium				016)
		y course MINT Teacher			3) (2016)	
	-	ee (1 major) Computatio		9)		
		ee (1 major) Mathematic	-			
waster's w	itri 1 majoi	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 86 / 281



Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

Module	Aodule title				Abbreviation	
Optima	l Contr	ol			10-M=VOST-161-mc)1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
5	nume	rical grade				
Duratio		Module level	Other prerequisites			
1 seme	ster	graduate				
Conten		3	1			
Basics in optimal control of ordinary and partial differential equations, theory of optimal control, conditions for optimality, methods for numerical solution. Recommended previous knowledge: We recommend basic knowledge of functional analysis and ordinary differential equations, such as can be acquired in the modules "Introduction to Functional Analysis" and "Ordinary Differential Equations". Knowledge of the contents of the module "Basics in Optimization" may also be useful. Intended learning outcomes The student is acquainted with advanced methods in optimal control. He gains the ability to work on contemporary research questions in continuous optimization. Courses (type, number of weekly contact hours, language – if other than German) V (3) + Ü (1) Module taught in: German and/or English Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination in groups (groups of 2, approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester						
credita	-					
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	е				
Referre	d to in	LPO I (examination regulation	ns for teaching-degree progra	mmes)		
Module	20002	ore in				
Master Master Master Master Master Supple	Module appears in Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's with 1 major Mathematical Physics (2020) JMU Würzburg • generated 19-Apr-2025 • exam. reg. da- page 88 / 281					
master S W	itir i majol	mathematical Physics (2020)	-	(120 ECTS) Mathematische Pl	-	page 88 / 281

Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

UNIVERSITÄT

WÜRZBURG

Module	Module title				Abbreviation	
Netwo	Networked Systems				10-M=VVSY-161-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	Its		•			
Contemporary topics in networked linear and non-linear dynamical systems (homogenous and non-homogenous systems); analysis of control-theoretical aspects (controllability, accessibility, etc.). Recommended previous knowledge:						
		lge of the contents of th	e module "Ordinary D	ifferential Equations'	' is useful.	
		ning outcomes				
The stu	ident is	acquainted with advan ary research questions			ems. He gains the a	bility to work
Course	S (type, r	number of weekly contact hours	, language — if other than Gei	rman)		
V (3) + Module		t in: German and/or Eng	lish			
		sessment (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester						
Allocat	ble for					
Allocal		Jaces				
	1. 6		_			
Additio	onal inf	ormation				
Worklo	ad		_			
150 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
Module	e appea	ars in				
	-	ee (1 major) Mathematic				
	-	ee (1 major) Mathematic				
	-	ee (1 major) Computatio			ork Dovoria (END) (a.	216)
		ning degree Gymnasium Ty course MINT Teacher I				(010
		ee (1 major) Computatio			(2010)	
	-	ee (1 major) Mathematic		71		
	-	ning degree Gymnasium	-	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	D20)
		r Mathematical Physics (2020)	JMU Würzburg •	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	m. reg. da-	page 90 / 281

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	Module title				Abbreviation		
Comple	ex Geor	netry			10-M=VKGE-161-mc	91	
Module	e coord	inator		Module offered by			
Dean of	f Studi	es Mathematik (Mather	natics)) Institute of Mathematics			
ECTS		od of grading		Dnly after succ. compl. of module(s)			
10		rical grade		•			
Duratio		Module level	Other prerequisites				
1 seme	ster	graduate					
Conten		3	_1				
The module builds on the topics covered in module 10-M=ADGM and discusses these in more detail: Wirtinger calculus, complex structures and complex manifolds, metrics on complex manifolds (e. g. conformal, hermitian, Kähler), differential operators on complex manifolds, classification of complex manifolds. Recommended previous knowledge: Basic knowledge of the contents of the modules "Introduction to Complex Analysis" and " Complex Analysis" or "Geometric Complex Analysis" is recommended. Intended learning outcomes The student knows and masters advanced methods and notions in complex differential geometry. He is familiar with the central concepts in this fied and is able to apply the fundamental proof methods independently. Courses (type, number of weekly contact hours, language – if other than German) V (4) + Ü (2) Module taught in: German and/or English Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester							
credital Allocat							
Allocal		Jaces					
Additio	nal inf	ormation					
Auuitio	liat III						
 Worklo							
	au						
300 h							
Teachir	ıg cyci	e					
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)			
Module appears in							
	-	ee (1 major) Mathemati					
	-	ee (1 major) Mathemati	•	6)			
	-	ee (1 major) Computatio ning degree Gymnasiun			ork Bayaria (ENR) (a	16)	
		y course MINT Teacher				,10)	
		ee (1 major) Computatio					
		Mathematical Physics (2020)		generated 19-Apr-2025 • exa	ım. reg. da-	page 92 / 281	
			ta record Master	(120 ECTS) Mathematische P	hysik - 2020		

Master's degree (1 major) Mathematics (2019)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	e title				Abbreviation	
Partial	Differe	ntial Equations of Mathe	10-M=VPDP-161-m01			
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics	
ECTS	r –	od of grading	Only after succ. com			
10		rical grade				
Duratio		Module level	Other prerequisites			
1 seme		graduate				
Conten		Sidduite				
examp ons an Recom Basic k	les; init d gener mende nowled	tial and boundary value p ralisations; Hilbert space d previous knowledge: dge from the modules "O	problems; well-posed e methods; Sobolev sp rdinary Differential Ec	and ill-posed proble paces and Fourier tra quations" and "Introd	duction to Partial Differential	
•		recommended, as well a ning outcomes	s basic knowledge of	functional analysis.		
The stu equatio	ident is ons, as	acquainted with fundar	les from mathematica	l physics. He/She is	the theory of partial differential able to establish a connection ons in physics.	
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	man)		
V (4) +						
Module	e taugh	t in: German and/or Eng	lish			
		sessment (type, scope, langua ile for bonus)	age — if other than German, e	examination offered — if no	ot every semester, information on whether	
b) oral c) oral Langua	examir examin ge of a ment o	mination (approx. 90 to station of one candidate e lation in groups (groups ssessment: German or E ffered: In the semester in bonus	each (approx. 20 minu of 2, 15 minutes per ca nglish	ites) or andidate)	ubsequent semester	
Allocat						
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi		e	-			
	-5 -9-1	-				
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
				iiiiies)		
Module	e appea	ars in				
	-	ee (1 major) Mathematic				
	-	ee (1 major) Physics (201				
	-	ee (1 major) Mathematics	•			
	-	ee (1 major) Computation hing degree Gymnasium			ork Bavaria (ENB) (2016)	
		r Mathematical Physics (2020)		generated 19-Apr-2025 • exa		
	1		-	(120 ECTS) Mathematische P		

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title				Abbreviation	
Pseudo Riem	annian and Riemannian	Geometry		10-M=VPRG-161-mo)1
Module coord	linator		Module offered by		
Dean of Stud	ies Mathematik (Mather	natics)	Institute of Mathem	natics	
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)		
10 numerical grade					
Duration	Module level	Other prerequisites			
1 semester	graduate				
Contents					
The module builds on the topics covered in module 10-M=ADGM and discusses these in more detail: Rieman- nian and pseudo-Riemannian manifolds, Levi-Civita connection and curvature, geodesics and the exponential map, Jacobi fields, comparison theorems in Riemannian geometry, submanifolds, integration, d'Alembert and Laplace operators, causal structure of Lorenz manifolds, Einstein equations and applications in general relativity theory. Recommended previous knowledge: Advanced knowledge of differential geometry is required, such as can be acquired in the module "Differential Geometry". Knowledge of the contents of the modules "Introduction to Topology", "Geometric Mechanics" and					
	s also recommended.				
manifolds. He thematics and	s acquainted with advai e/She is able to establis d questions in physics.	h a connection betwee	en his/her acquired s		
	number of weekly contact hour	s, language — if other than Ger	rman)		
V (4) + Ü (2) Module taught in: German and/or English					
	sessment (type, scope, lang		examination offered — if no	t every semester, informat	ion on whether
module is credita				· · ·	
b) oral exami c) oral exami Language of a	mination (approx. 90 to nation of one candidate nation in groups (groups assessment: German or offered: In the semester bonus	each (approx. 20 minu s of 2, 15 minutes per c English	utes) or andidate)	ıbsequent semester	
Allocation of	places				
Additional in	formation				
Workload					
300 h					
Teaching cyc	le				
Referred to in	LPOI (examination regulation	ons for teaching-degree progra	mmes)		
Module appe					
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016)					
Master's with 1 majo	or Mathematical Physics (2020)	JMU Würzburg •	generated 19-Apr-2025 • exa	am. reg. da-	page 96 / 281

Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025)

Module title				Abbreviation			
Functional Analysis 10-M=AFAN-161-m01						1	
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathema		atics)	Institute of Mathem	atics			
ECTS	S Method of grading Only after succ. compl. of module(s)						
10	nume	rical grade					
Duration Module level Other prerequisites							
1 seme	ster	graduate					
Conten	Contents						
functio	nal ana	ilbert spaces, bounded alysis and applications to d previous knowledge:			s, further contempor	ary topics in	
		h the contents of the mo	dule "Advanced Anal	vsis" is strongly reco	mmended.		
		ning outcomes		,			
	-	acquainted with fundar	nental concents and r	nethods in a contem	norary field of functi	onal analy-	
		e to apply these skills to				onaranaty	
Course	S (type, r	number of weekly contact hours,	language — if other than Gei	rman)			
V (4) + Module		t in: German and/or Eng	lish				
			-		· ······ · · · · · · · · · · · · · · ·		
		sessment (type, scope, langu- ile for bonus)	age — If other than German,	examination offered — if no	t every semester, information	on on whether	
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester							
credita							
Allocat	ion of j	olaces					
Additio	onal inf	ormation					
Worklo	ad						
300 h							
Teachi	ng cycl	е					
Referre	ed to in	LPOI (examination regulation	is for teaching-degree progra	mmes)			
Module appears in							
Master's degree (1 major) Mathematics (2016)							
Master's degree (1 major) Mathematical Physics (2016)							
Master's degree (1 major) Computational Mathematics (2016)							
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Master's degree (1 major) Computational Mathematics (2019)							
Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
		r Mathematical Physics (2020)		generated 19-Apr-2025 • exa		D2O) page 98 / 281	
				(120 ECTS) Mathematische Ph		Page 30 / 201	

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title					Abbreviation		
Applied Differential Geometry 10-M=VADG-161-m01)1		
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathemat			atics)	s) Institute of Mathematics			
ECTS Method of grading Only after succ. c			Only after succ. com	pl. of module(s)			
10	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semes	ster	graduate					
Conten	ts						
tial geo timisati Recomr Advanc Geomet "Pseud	The module builds on the topics covered in module 10-M=ADGM and discusses selected applications of differen- tial geometry, e. g. at the interface of control theory and mechanics (subriemannian geometry), in the smooth op- timisation on manifolds or applications in physics. Recommended previous knowledge: Advanced knowledge of differential geometry is required, such as can be acquired in the module "Differential Geometry". Knowledge of the contents of the modules "Applied Differential Geometry", "Geometric Mechanics", "Pseudo-Riemannian and Riemannian Geometry" and "Lie Theory" is also recommended.						
Intende	ed learn	ning outcomes					
		acquainted with selecte tion between his/her ac					
Courses	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)			
V (4) + l Module	• •	t in: German and/or Engl	ish				
		essment (type, scope, langua le for bonus)	ge — if other than German, e	xamination offered — if no	t every semester, informatio	on on whether	
b) oral (c) oral (Langua	examin examin ge of a ment o	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ssessment: German or En ffered: In the semester in bonus	ach (approx. 20 minu of 2, 15 minutes per ca nglish	tes) or andidate)	bsequent semester		
Allocati	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
300 h							
Teaching cycle							
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)			
Module	appea	irs in					
Master' Master'	s degre s degre	ee (1 major) Mathematics ee (1 major) Mathematica ee (1 major) Computation	al Physics (2016) al Mathematics (2010				
		ning degree Gymnasium l		on PLUS, Elite Netwo		page 100 / 281	
musici S WI	arimajul	mathematical i hysics (2020)		(120 ECTS) Mathematische Pl		puge 100 / 201	

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Mathematics (2023)

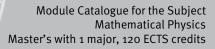
Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

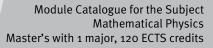
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title				Abbreviation				
Giovanni Prodi Lecture Selected Topics (Master)				10-M=VGPSin-152-r	n01			
Module coordinator				Module offered by				
Dean of Studies Mathematik (Mathema			matics)	Institute of Mathematics				
ECTS Method of grading				Only after succ. compl. of module(s)				
10	1	rical grade						
Duratio		Module level	Other prorequisites					
				ther prerequisites				
1 seme		graduate						
Conten								
		· ·	mathematics by an int	ernational expert.				
Intende	ed lear	ning outcomes						
themat	ics. He		undamental concepts a sh a connection betwee subjects.					
Course	S (type, r	number of weekly contact hour	s, language — if other than Ger	man)				
V (4) + Module		t in: English						
			uage — if other than German, o	examination offered — if no	t even comector informati	on on whether		
		le for bonus)	uage – Il other than German, G		tevery semester, mormati	on on whether		
b) oral c) oral Langua	examir examin Ige of a ment o	ation of one candidate ation in groups (group ssessment: English ffered: In the semester	o 120 minutes, usually o e each (approx. 20 minu s of 2, 15 minutes per c in which the course is	utes) or andidate)	ıbsequent semester			
Allocation of places								
Additio	onal inf	ormation						
Worklo	ad							
300 h								
Teachi		2						
Teacini	ig cyci	e						
Referre	ed to in	LPOI (examination regulati	ons for teaching-degree progra	mmes)				
Module								
	0	. , ,	cs International (2015)					
Master's degree (1 major) Mathematics (2016)								
Master's degree (1 major) Mathematical Physics (2016)								
Master's degree (1 major) Computational Mathematics (2016)								
Master's degree (1 major) Computational Mathematics (2019)								
Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Mathematical Physics (2020)								
Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Mathematics International (2021)								
Master's degree (1 major) Mathematics international (2021) Master's degree (1 major) Computational Mathematics (2022)								
	-	ee (1 major) Computati ee (1 major) Mathemati		<i>-</i> ,				
Master's wi	ith 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 102 / 281		



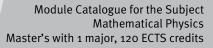
Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Mathematics International (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Mathematics International (2025) Master's degree (1 major) Mathematical Data Science (2025)

Module title Abbreviation								
Giovanni Prodi Lecture Advanced Topics (Master)					10-M=VGPAin-152-1	m01		
Module	e coord	inator		Module offered by				
Dean of Studies Mathematik (Mathema			natics)	Institute of Mathem	natics			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)				
10		rical grade		• • • •				
Duratio		Module level	Other prerequisites					
1 seme		graduate						
Conten		Sidduite						
		o a specialised topic in	mathematics by an int	ornational ovnort				
			mathematics by an im	emational expert.				
		ning outcomes						
themat	ics. He	acquainted with the fu /She is able to establis applications in other :	sh a connection betwee					
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)				
V (4) +	Ü (2)							
Module	e taugh	t in: English						
		sessment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether		
c) oral e Langua	examin ge of a ment o	ation of one candidate ation in groups (group ssessment: English ffered: In the semester bonus	s of 2, 15 minutes per c	andidate)	ubsequent semester			
Allocation of places								
Additio	nal inf	ormation						
Worklo	ad							
	au							
300 h		-						
Teachir	ig cyci	e						
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)				
Module	e appea	ars in						
	-	ee (1 major) Mathemat	-					
Master's degree (1 major) Mathematics (2016)								
Master's degree (1 major) Mathematical Physics (2016)								
Master's degree (1 major) Computational Mathematics (2016)								
Master's degree (1 major) Computational Mathematics (2019)								
Master's degree (1 major) Mathematics (2019)								
Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Mathematics International (2021)								
Master's degree (1 major) Mathematics international (2021) Master's degree (1 major) Computational Mathematics (2022)								
Master's degree (1 major) Mathematics (2022)								
Master's wi	th 1 majo	r Mathematical Physics (2020)		generated 19-Apr-2025 • exa (120 ECTS) Mathematische P		page 104 / 281		



Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Mathematics International (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Mathematics International (2025)

Module title					Abbreviation			
Giovanni Prodi Lecture Modern Topics (Master)				10-M=VGPMin-152-	m01			
Module	e coord	inator		Module offered by				
Dean of Studies Mathematik (Mathema			natics)	Institute of Mathematics				
ECTS Method of grading Only a			Only after succ. con	nly after succ. compl. of module(s)				
10		rical grade		•				
Duration Module level Other prerequisites								
1 seme		graduate						
Conten		Sidduite						
			mathamatics by an int	ornational ovnart				
		o a specialised topic in	mathematics by an im	emational expert.				
		ning outcomes						
themat	ics. He	acquainted with the fu /She is able to establis applications in others	sh a connection betwee					
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)				
V (4) +								
		t in: English						
		sessment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether		
c) oral e Langua	examin ge of a ment o	ation of one candidate ation in groups (group ssessment: English ffered: In the semester bonus	s of 2, 15 minutes per c	andidate)	ubsequent semester			
Allocation of places								
Additio	nal inf	ormation						
Worklo	ad							
	au							
300 h		-						
Teachir	ig cyci	e						
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)				
Module	e appea	ars in						
	-	ee (1 major) Mathemati	-					
Master's degree (1 major) Mathematics (2016)								
Master's degree (1 major) Mathematical Physics (2016)								
Master's degree (1 major) Computational Mathematics (2016)								
Master's degree (1 major) Computational Mathematics (2019)								
Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Mathematical Physics (2020)								
Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Mathematics International (2021)								
Master's degree (1 major) Mathematics international (2021) Master's degree (1 major) Computational Mathematics (2022)								
	-	ee (1 major) Computati ee (1 major) Mathemati						
Master's wi	th 1 majo	r Mathematical Physics (2020)		generated 19-Apr-2025 • exa (120 ECTS) Mathematische P		page 106 / 281		



Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Mathematics International (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Mathematics International (2025)

Module title				Abbreviation				
Geometric Complex Analysis 10-M=VGFT-192-m01)1			
Module coordinator				Module offered by				
Dean of Studies Mathematik (Mathema		atics)	Institute of Mathem	atics				
ECTS Method of grading		Only after succ. compl. of module(s)						
10	nume	rical grade						
Duratio	on	Module level	Other prerequisites	ther prerequisites				
1 seme	ster	graduate						
Conten	Contents							
trics, q Recom	uasicor mende	hods and results in geor nformal maps, harmonic d previous knowledge:	functions, biholomor	phic maps).				
Basic k	nowled	lge of the contents of the	e module "Introductio	n to Complex Analys	is" is recommended			
Intend	ed learn	ning outcomes						
able cl	assify t	acquainted with fundan hese results within more other fields of mathemat	general theories and					
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	rman)				
V (4) + Module		t in: German and/or Engl	lish					
		s essment (type, scope, langua le for bonus)	age — if other than German, o	examination offered — if no	t every semester, informati	on on whether		
 a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus 								
Allocat	ion of p	olaces						
Additio	nal inf	ormation						
Auditio								
 Worklo								
	<u>au</u>							
300 h								
Teachi	ng cycl	e						
Referred to in LPO I (examination regulations for teaching-degree programmes)								
Module appears in								
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)								
Master's w	ith 1 majoı	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 108 / 281		

Module	title				Abbreviation		
Selecte	d Topi	cs in Numerical and App	lied Mathematics		10-M=VNAM-192-m	101	
Module	coord	inator		Module offered by			
		es Mathematik (Mathema	atics)	Institute of Mathem	atics		
			F				
			Only after Succ. con	Only after succ. compl. of module(s)			
10 Duratio		rical grade Module level	 Other prerequisites	Other preservicites			
			Other prerequisites				
1 seme	l	graduate					
Conten							
lopmer	its and	ission of a specialised to interrelations with other d previous knowledge:			taking into account	recent deve-	
Depend	ding on	the content, basic and a			of applied mathema	itics is requi-	
		doubt, it is recommende	ed to consult the lectu	urer.			
		ning outcomes					
		acquainted with advanc hese to complex probler		ed topic in numerica	l or applied mathem	atics, and is	
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	man)			
V (4) + Module		t in: German and/or Engl	ish				
		s essment (type, scope, langua le for bonus)	age — if other than German, e	examination offered — if no	t every semester, informat	ion on whether	
b) oral c) oral (Langua	examin examin ge of a ment o	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups o ssessment: German or E ffered: In the semester ir bonus	each (approx. 20 minu of 2, 15 minutes per ca nglish	ites) or andidate)	ıbsequent semester		
Allocat	ion of p	olaces					
			,				
Additio	nal info	ormation					
Worklo							
	~~						
300 h		•					
Teachi	ig cycl	e					
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)			
Module				<u>`</u>			
Master Master Supple Master Master	's degre 's teach mentar 's degre 's degre	ee (1 major) Computatior ee (1 major) Mathematics ning degree Gymnasium y course MINT Teacher E ee (1 major) Mathematica ee (1 major) Economathe ee (1 major) Computatior	s (2019) MINT Teacher Educati ducation PLUS, Elite I al Physics (2020) matics (2021)	ion PLUS, Elite Netwo Network Bavaria (EN		020)	
	-	Mathematical Physics (2020)		generated 19-Apr-2025 • exa	am. reg. da-	page 110 / 281	
				(120 ECTS) Mathematische P		P030 110 / 201	

Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

Module title				Abbreviation		
Crypto	graphy	/Coding Theory			10-M=VKRY-192-mc	01
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Error detection and error correction, linear codes, channel coding theorems of Shannon, classical and contempo- rary codes, bounds, network codes, connections to cryptography. Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".						
Intend	ed lear	ning outcomes				
is able	to clas	acquainted with funda sify these results within phy with other fields of	more general theories			
Course	S (type, r	number of weekly contact hours	, language — if other than Ger	rman)		
V (4) + Module		t in: German and/or Eng	lish			
module is	s creditab	s essment (type, scope, langu le for bonus)			t every semester, informati	on on whether
b) oral c) oral Langua	examir examin Ige of a ment o	mination (approx. 90 to nation of one candidate ation in groups (groups ssessment: German or I ffered: In the semester i bonus	each (approx. 20 minu of 2, 15 minutes per c English	utes) or andidate)	bsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	immes)		
Module	e appea	urs in				
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's with 1 major Mathematical Physics (2020) Muster's with 1 major Mathematical Physics (2020) Master's with 1 major Mathematical Physics (2020)						
			-	(120 ECTS) Mathematische Pl	-	P030 112 / 201

Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Mathematical Data Science (2025)

Module	Module title				Abbreviation		
Compu	ter Alg	ebra			10-M=VCAL-192-mc	01	
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
10	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate					
Contents							
Fast multiplication of numbers, polynomials and matrices, fast chinese remainder theorem; factorisation of po- lynomials over finite fields; lattices, lattice basis reduction and LLL-algorithm; factorisation of rational polynomi- als, symbolic integration of rational functions; exact arithmetic with algebraic numbers; multivariate polynomi- als, Gröbner basis, Buchberger's algorithm, algorithms for permutation groups. Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and							
"Applie							
Intende	ed lear	ning outcomes					
The stu puter a		nows about the theoretic	cal foundations and th	ne possible applicati	ons of several meth	ods in com-	
Course	S (type, r	umber of weekly contact hours,	language — if other than Ge	rman)			
V (4) + Module		t in: German and/or Eng	lish				
	_	sessment (type, scope, langu		examination offered — if no	t every semester, informati	on on whether	
		le for bonus)			· ·		
b) oral c) oral Langua	examir examin Ige of a ment o	mination (approx. 90 to ation of one candidate ation in groups (groups ssessment: German or E ffered: In the semester i bonus	each (approx. 20 minu of 2, 15 minutes per c English	utes) or andidate)	ıbsequent semester		
Allocat			_				
Additio	onal inf	ormation					
			_				
Worklo	ad		_				
300 h							
Teachi	ng cycl	e					
Referre	ed to in	LPO I (examination regulation	ns for teaching-degree progra	ummes)			
Module	Module appears in						
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's with 1 major Mathematical Physics (2020) Master's with 1 major Mathematical Physics (2020) Master's with 1 major Mathematical Physics (2020)							
			-	(120 ECTS) Mathematische P	-		

Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title				Abbreviation		
Algorit	hmic N	umber Theory			10-M=VAZT-192-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites	i		
1 seme	ster	graduate				
Conten	ts					
Binary numbers, computation of the greatest common divisor, pseudoprime tests, computation of primitive roots. Primality tests for Fermat and Mersenne numbers, factorisation methods (Pollard-Rho, (p-1)-method, ellip- tic curve method, quadratic sieve method), discrete logarithm. Recommended previous knowledge: Basic knowledge of algebra and number theory is assumed, such as can be acquired in the modules "Introducti- on to Algebra", "Introduction to Number Theory" and "Applied Algebra".						
Intende	ed lear	ning outcomes				
		nows about the theoretier theory.	cal foundations and th	ne possible applicati	ons of several metho	ods in algo-
Course	S (type, r	umber of weekly contact hours,	language — if other than Ger	rman)		
V (4) + Module		t in: German and/or Eng	lish			
Metho	d of ass	essment (type, scope, langu	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
		le for bonus)				
b) oral c) oral Langua	examir examin ge of a ment o	mination (approx. 90 to ation of one candidate ation in groups (groups ssessment: German or E ffered: In the semester i bonus	each (approx. 20 minu of 2, 15 minutes per c English	utes) or andidate)	ibsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulatio	ns for teaching-degree progra	immes)		
Module	e appea	nrs in				
Module appears in Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's with 1 major Mathematical Physics (2020) JMU Würzburg • generated 19-Apr-2025 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2020						
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Module	Module title				Abbreviation	
Algebra						01
Module	e coord	inator		Module offered by		
Dean o	fStudie	es Mathematik (Mathem	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Affine and projective space, affine and projective varieties, morphisms and rational maps; function fields, divisors and Riemann-Roch theorem for curves; genus, singularities and Plücker formula; dual curve, dual surface; Bezout's theorem; Grassmann and flag varieties; 27 lines in a cubic surface. Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".						
Intend	ed learr	ning outcomes				
classify	/ these	acquainted with funda results within more gen mathematics.				
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	rman)		
V (4) + Module		t in: German and/or Eng	lish			
		s essment (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
b) oral c) oral Langua Assess	examin examin Ige of a	nination (approx. 90 to ation of one candidate ation in groups (groups ssessment: German or B ffered: In the semester i bonus	each (approx. 20 minu of 2, 15 minutes per c English	utes) or andidate)	bsequent semester	
Allocat						
	F					
Additio	onal info	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	9				
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	ammes)		
Module	e appea	irs in				
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)						
waster's W	iui i major	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 118 / 281

Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title				Abbreviation			
Semina	ar in Al	gebra			10-M=SALG-161-mc	01	
Module	e coord	inator		Module offered by			
Dean of	f Studi	es Mathematik (Mathem	atics)	tics) Institute of Mathematics			
ECTS		od of grading	Only after succ. con	npl. of module(s)			
5		rical grade		1			
Duratio		Module level	Other prerequisites				
1 seme	ster	graduate					
Conten		3					
		c in algebra.					
	nowled	d previous knowledge: lge of algebra is assume bra".	d, such as can be acc	quired in the module	s "Introduction to Al	gebra" and	
Intende	ed lear	ning outcomes					
		able to elaborate a cont the available literature, p					
Course	S (type, r	number of weekly contact hours,	language — if other than Gei	rman)			
S (2) Module taught in: German and/or English							
		sessment (type, scope, langua		examination offered — if no	t every semester, informati	ion on whether	
		le for bonus)					
talk (6c	to 120	o minutes)					
		ssessment: German or E ffered: In the semester ir		offered and in the su	ıbsequent semester		
Allocat			-				
Additio	nal inf	ormation	-				
Worklo	ad						
150 h							
Teachir	ng cycl	e					
		-					
Referre	d to in	LPOI (examination regulation	s for teaching-degree progra	mmes)			
Module	e appea	ars in					
Master	's degr	ee (1 major) Mathematic	5 (2016)				
	-	ee (1 major) Mathematica					
		ning degree Gymnasium				016)	
		y course MINT Teacher E		Network Bavaria (ENI	B) (2016)		
	-	ee (1 major) Mathematic: ning degree Gymnasium	•	ion PLLIS Flite Netwo	ork Bavaria (FNB) (20	020)	
		y course MINT Teacher E					
		ee (1 major) Mathematica			/ X = -/		
Master's degree (1 major) Computational Mathematics (2022)							
Master	's degr	ee (1 major) Mathematic	5 (2022)				
Master's wi	ith 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 120 / 281	

Module	e title				Abbreviation	
Semina	ar in Dy	namical Systems and Co	ntrol		10-M=SDSC-161-mc	01
Module	e coordi	inator		Module offered by		
		es Mathematik (Mathema	atics)	Institute of Mathem	atics	
			Only after succ. con			
5	· · · · · ·	rical grade				
5 Duratio	ı	Module level	Other prerequisites			
1 seme		graduate				
Conten		graduate	<u> </u>			
		a in dynamical systems a	and control			
A modern topic in dynamical systems and control.						
		d previous knowledge: the contents of the modu	ule "Mathematical Co	ntrol Theory" or "Cor	ntrol Theory" is requi	ired.
Intende	ed learr	ning outcomes				
		able to elaborate a cont the available literature, p				
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)		
S (2) Module	e taughi	t in: German and/or Engl	ish			
Metho	d of ass	essment (type, scope, langua le for bonus)		examination offered — if no	t every semester, informati	ion on whether
		minutes)				
Langua	ge of a	ssessment: German or Ei ffered: In the semester ir		offered and in the su	ıbsequent semester	
Allocat						
Additio	nal info	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	9				
		-				
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
			a lor reaching-degree progra			
Module		rc in				
		ee (1 major) Mathematics	(2016)			
	-	ee (1 major) Economathe				
	-	ee (1 major) Leonomatile				
	-	ning degree Gymnasium	-	ion PLUS. Elite Netwo	ork Bavaria (FNB) (วง	016)
		y course MINT Teacher E				/
		ee (1 major) Mathematics			/ X · · ·/	
	-	ning degree Gymnasium I	-	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	020)
		y course MINT Teacher E				
		ee (1 major) Mathematica		`		
Master's degree (1 major) Harrennaricar (1) (2020) Master's degree (1 major) Economathematics (2021)						
Master's degree (1 major) Computational Mathematics (2022)						
Anctow-	th 1 major	Mathematical Physics (2020)	IMII Würzburg	generated 19-Apr-2025 • exa	um rog da	
VIDSIPE'S WI						page 122 / 281



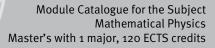
Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023)

Module title					Abbreviation		
Semina	r in Co	mplex Analysis			10-M=SCOA-161-m	01	
Module	coord	inator		Module offered by			
Dean of	fStudi	es Mathematik (Mathema	atics)				
ECTS		od of grading		Only after succ. compl. of module(s)			
5		rical grade		•			
Duratio		Module level	Other prerequisites				
1 seme	ster	graduate	 				
Conten		0	<u>I</u>				
		c in complex analysis.					
Recommended previous knowledge: Basic knowledge of the contents of the modules "Introduction to Complex Analysis" and " Complex Analysis" is recommended.							
Intende	ed lear	ning outcomes					
		able to elaborate a cont the available literature, p					
Course	S (type, r	number of weekly contact hours,	language — if other than Gei	rman)			
S (2) Module taught in: German and/or English							
		sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, informati	ion on whether	
talk (6c) to 120	o minutes)					
Langua	ge of a	ssessment: German or E ffered: In the semester ir		offered and in the su	ıbsequent semester		
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
			-				
Worklo	ad						
150 h							
Teachir	ng cycl	e					
		-					
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)			
Module	e appea	ars in					
	-	ee (1 major) Mathematics					
	-	ee (1 major) Mathematica	•		ril Deverie (END) (e.		
		ning degree Gymnasium				016)	
		y course MINT Teacher E ee (1 major) Mathematics		NELWOIK DAVAIIA (ENI	(2010)		
	-	ning degree Gymnasium	-	ion PLUS. Elite Netwo	ork Bavaria (FNB) (20	020)	
		y course MINT Teacher E				,	
		ee (1 major) Mathematica					
	-	ee (1 major) Computatior	•	2)			
	Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematics (2022)						
Master's wi	th 1 maio	r Mathematical Physics (2020)	IMU Würzhuro●	generated 19-Apr-2025 • exa	ım. reg. da-	page 124 / 281	
			-	(120 ECTS) Mathematische P	-		

Module	e title		Abbreviation				
Semina	ar in Ap	plied Differential Geom	ietry		10-M=SADG-161-m	01	
Module	e coord	inator		Module offered by			
Dean of	f Studi	es Mathematik (Mather	natics)	tics) Institute of Mathematics			
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
5	nume	rical grade					
Duratio	n	Module level	Other prerequisites	;			
1 seme	ster	graduate					
Conten	ts	~					
A modern topic in applied differential geometry.							
Advanc Geome	ed kno try". Kr	d previous knowledge: owledge of differential g nowledge of the content nannian and Riemannia	s of the modules "App	lied Differential Geo	metry", "Geometric N		
Intende	ed lear	ning outcomes					
		able to elaborate a con the available literature,					
Course	S (type, r	number of weekly contact hours	, language — if other than Ge	rman)			
S (2) Module							
		sessment (type, scope, lang		examination offered — if no	t every semester, informati	ion on whether	
		le for bonus)					
		o minutes)					
		ssessment: German or ffered: In the semester		offered and in the su	ibsoquant comostor		
Allocat				onereu anu în the st	ibsequent semester		
Allocal							
Additio	nal inf	ormation					
Additio	ilat illi	ormation					
Worklo	ad						
150 h	au						
Teachir		0					
Teacim	ig cyci	c					
Poforro	d to in	LPOI (examination regulation	no for too shing dograd progre				
Kelene							
Module	e appea	ars in					
		ee (1 major) Mathemati	cs (2016)				
Master'	's degr	ee (1 major) Mathemati	cal Physics (2016)				
		hing degree Gymnasiun				016)	
		ry course MINT Teacher ee (1 major) Mathemati		Network Bavaria (EN	B) (2016)		
	-	hing degree Gymnasiun	-	ion PLUS. Elite Netwo	ork Bavaria (ENB) (20	020)	
		ry course MINT Teacher				- /	
Master'	's degr	ee (1 major) Mathemati	cal Physics (2020)				
Master	Master's degree (1 major) Computational Mathematics (2022)						
Master's wi	ith 1 majo	r Mathematical Physics (2020)	-	• generated 19-Apr-2025 • exa · (120 ECTS) Mathematische P	-	page 126 / 281	

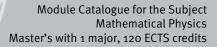
Module title				Abbreviation			
Semina	r in Ge	ometry and Topology			10-M=SGTO-161-mo	01	
Module	coord	inator		Module offered by			
Dean of	fStudi	es Mathematik (Mathem	atics)	ics) Institute of Mathematics			
ECTS		od of grading	E Contraction of the second se	Only after succ. compl. of module(s)			
5		rical grade					
Duratio		Module level	Other prerequisites				
1 seme		graduate					
Conten		3.444440					
		c in geometry and topol					
		d previous knowledge:	- 3) -				
		lge of the contents of the commended.	e modules "Introducti	on to Differential Geo	ometry" and "Introdu	uction to To-	
Intende	ed lear	ning outcomes					
		able to elaborate a cont the available literature, j					
		umber of weekly contact hours,					
S (2)				inany			
	taugh	t in: German and/or Eng	lish				
		s essment (type, scope, langua	age — if other than German,	examination offered — if no	t every semester, informat	ion on whether	
		o minutes)					
Langua	ge of a	ssessment: German or E ffered: In the semester in		offered and in the su	ıbsequent semester		
Allocat					•		
Additio	nal inf	ormation					
Worklo	ad						
150 h	uu						
Teachir		0	-				
Teacini	ig cyci	6					
 Deferre	d to in			`			
Referre	αιοιη	LPO I (examination regulation	is for teaching-degree progra	mmes)			
Module	annea	ors in					
		ee (1 major) Mathematic	s (2016)				
	0	ee (1 major) Mathematic	. ,				
	-	ning degree Gymnasium	· · ·	ion PLUS, Elite Netwo	ork Bavaria (ENB) (2	016)	
		y course MINT Teacher E				ŗ	
Master'	s degr	ee (1 major) Mathematic	s (2019)				
		ning degree Gymnasium				020)	
		y course MINT Teacher E		Network Bavaria (EN	B) (2020)		
Master's degree (1 major) Mathematical Physics (2020)							
Master's degree (1 major) Computational Mathematics (2022)							
Master'	s degr	ee (1 major) Mathematic	5 (2022)			I	
Master's wi	th 1 majo	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 128 / 281	

Module title				Abbreviation			
Giovan	ni Prod	li Seminar (Master)			10-M=SGPCin-152-r	n01	
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics		
ECTS		od of grading		Dnly after succ. compl. of module(s)			
5		rical grade					
Duratio		Module level	Other prerequisites				
	0						
1 seme		graduate					
Conten	ts						
A mode	ern topi	ic in the research expertis	se of the current hold	er of the Giovanni Pr	odi Chair.		
Intende	ed lear	ning outcomes					
The stu	dent is	able to elaborate a cont	emporary research to	pic. This includes co	mprehending and st	tructuring of	
		the available literature, p					
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)			
S (2)		, ,	0.0	•			
	e taugh	t in: English					
		sessment (type, scope, langua	ge — if other than German	examination offered — if no	t every comector informati	on on whether	
		le for bonus)			cevery semester, mormati	on on whether	
		o minutes)					
		ssessment: English					
		ffered: In the semester in	which the course is	offered and in the su	ıbsequent semester		
Allocat	ion of I	olaces					
Additio	nalinf	ormation					
Auuitio	inat init						
Worklo	ad						
150 h							
Teachir	ng cycl	e					
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)			
Modula		are in					
Module							
	-	ee (1 major) Mathematics	-				
	-	ee (1 major) Mathematics					
	-	ee (1 major) Economathe					
	-	ee (1 major) Mathematica	•				
		ee (1 major) Computation					
	-	ee (1 major) Computation		9)			
	-	ee (1 major) Mathematics	-				
	-	ee (1 major) Mathematica	-				
	-	ee (1 major) Mathematics					
	-	ee (1 major) Economathe					
Master	's degr	ee (1 major) Computation	al Mathematics (202	2)			
Master's degree (1 major) Mathematics (2022)							
Master's degree (1 major) Mathematical Physics (2022)							
Master	's degr	ee (1 major) Mathematics	International (2022)				
Master's wi	ith 1 majo	r Mathematical Physics (2020)		generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 130 / 281	



Master's degree (1 major) Economathematics (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's degree (1 major) Mathematics International (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

Module	Module title				Abbreviation		
Interdis	sciplina	ary Seminar			10-M=SIDC-161-mo	1	
Module	coord	inator		Module offered by			
Dean of	fStudi	es Mathematik (Mathem	natics)	ics) Institute of Mathematics			
ECTS		od of grading		Only after succ. compl. of module(s)			
5	nume	rical grade					
Duratio		Module level	Other prerequisites				
1 semes		graduate					
Conten		gladdate					
	A modern topic in mathematics with interdisciplinary aspects.						
Intende	ed lear	ning outcomes					
		able to elaborate a con the available literature,					
Courses	S (type, r	number of weekly contact hours,	language — if other than Ger	man)			
S (2) Module	taugh	t in: German and/or Eng	lish				
		sessment (type, scope, langu	·	examination offered — if no	t every semester informati	ion on whether	
		le for bonus)			every semester, morman	on on whether	
talk (60	to 120	o minutes)					
		ssessment: German or I	English				
		ffered: In the semester i		offered and in the su	ıbsequent semester		
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
150 h							
Teachir	ıg cvcl	e					
	<u> </u>						
Referre	d to in	LPO I (examination regulatio	ns for toaching dogroo progra	mmoc)			
Referre				innes)			
Modula		are in					
Module							
	-	ee (1 major) Mathematic					
	-	ee (1 major) Economath ee (1 major) Mathematic					
	-	ee (1 major) Mathematic ee (1 major) Computatio	•	(٢)			
	-	ning degree Gymnasium			ork Powaria (END) (a	or (-)	
		y course MINT Teacher l				010)	
		ee (1 major) Computatio			U) (2010)		
	-	ee (1 major) Mathematic		<i>YI</i>			
	-	ning degree Gymnasium	-	on PILIS Flite Netwo	ork Bayaria (FNR) (a	020)	
		y course MINT Teacher I				020)	
		•					
Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021)							
Master's degree (1 major) Economational Mathematics (2021) Master's degree (1 major) Computational Mathematics (2022)							
	Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)						
				generated to Apr acces	am rog da	nago 100 / 001	
master's Wi	ur i majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 132 / 281	



Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Economathematics (2025)

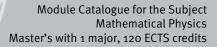
Module title					Abbreviation		
Seminar Mathematics in the Sciences					10-M=SMSC-161-m	01	
Module coordinator							
			nation)	Module offered by			
Dean of Studies Mathematik (Mathematics				Institute of Mathem	Idilles		
ECTS	1	od of grading	Only after succ. com	ipi. of module(s)			
5		rical grade					
Duratio	on	Module level	Other prerequisites				
1 semester graduate							
Contents							
A mode	ern topi	c in mathematics in the	sciences.				
		d previous knowledge: Ige from the modules "C	Irdinany Differential Ec	unations" and "Intro	duction to Dartial Dif	Forontial	
		recommended, as well a			uction to Partial Di	rerentiat	
		ning outcomes		ranetionat anatysis.			
	-		tomporoni kosarish ta	nic This includes	mprohending	tructurinf	
		able to elaborate a con the available literature,					
· · · ·		number of weekly contact hours,	<u> </u>				
	J (type, r	iumber of weekly contact nours,	, ianguage — n other than Ger	man			
S (2) Module	- taugh	t in: German and/or Eng	rlish				
		sessment (type, scope, langu le for bonus)	iage — II other than German, e	examination offered — if no	n every semester, informat	ion on whether	
		o minutes)					
		ssessment: German or I	English				
		ffered: In the semester i		offered and in the su	ubsequent semester		
Allocat	ion of p	olaces					
Additio	onal inf	ormation					
Worklo	bed						
150 h			_				
Teachi	ng cycl	е					
			_				
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)			
Module	e appea	urs in					
Master's degree (1 major) Mathematics (2016)							
Master's degree (1 major) Economathematics (2016)							
Master's degree (1 major) Mathematical Physics (2016)							
Master's degree (1 major) Computational Mathematics (2016)							
		ning degree Gymnasium				016)	
		y course MINT Teacher I			B) (2016)		
	-	ee (1 major) Computatio		97			
Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
Master's w	ith 1 majo	r Mathematical Physics (2020)		generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 134 / 281	

Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Economathematics (2025)

Comine	e title				Abbreviation	
Seminar in Numerical Mathematics and Applied Analysis					10-M=SNMA-161-m	01
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathematics)			Institute of Mathem	atics		
ECTS		•				
		od of grading	Only after succ. con	npl. of module(s)		
5 numerical grade						
Duration Module level		Other prerequisites	•			
1 semester graduate						
Conten	ts					
A mode	ern topi	c in numerical mathema	itics or applied analys	sis.		
		d previous knowledge:		c 1100 -	c b b b b b b b b b b	
		the content, basic and a				umerical ma-
		equired. In case of doub	i, it is recommended	to consult the lecture	21.	
	-	ning outcomes				
		able to elaborate a con				
· · ·		the available literature,		<u> </u>	ate in a scientific dis	cussion.
Course	S (type, r	umber of weekly contact hours,	language — if other than Ge	rman)		
S (2)						
Module	e taugh	t in: German and/or Eng	lish			
		s essment (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	ot every semester, informati	ion on whether
talk (60) to 120	minutes)				
-		ssessment: German or E	Inglish			
Assessment offered: In the semester in which the course is offered and in the subsequent semester						
Allocation of places						
Allocat	ion of p		n which the course is	offered and in the su	ubsequent semester	
Allocat	ion of p		n which the course is	offered and in the su	ubsequent semester	
		olaces	n which the course is	offered and in the su	ubsequent semester	
			n which the course is	offered and in the su	ubsequent semester	
 Additio	nal inf	olaces	n which the course is	offered and in the su	ubsequent semester	
 Additio Worklo	nal inf	olaces	n which the course is	offered and in the su	ubsequent semester	
 Additio Worklo 150 h	nal inf	olaces ormation	n which the course is	offered and in the su	ubsequent semester	
 Additio Worklo	nal inf	olaces ormation	n which the course is	offered and in the su	ubsequent semester	
 Additio Worklo 150 h	nal inf	olaces ormation	n which the course is	offered and in the su	ubsequent semester	
 Additio Worklo 150 h Teachin	ad ng cycl	olaces ormation			ubsequent semester	
 Additio Worklo 150 h Teachin	ad ng cycl	olaces ormation			ubsequent semester	
 Additio 150 h Teachir Referre	ad ng cycl	places prmation e LPOI (examination regulation			ubsequent semester	
 Additio 150 h Teachir Referre Module	nal inf ad ng cycl d to in	places prmation e LPO I (examination regulation	ns for teaching-degree progra		ubsequent semester	
 Additio 150 h Teachir Referre Module	ad ng cycl d to in e appea	places prmation e LPOI (examination regulation	15 for teaching-degree progra		ubsequent semester	
 Additio 150 h Teachir Referre Master Master	ad ad ad ad to in a appea	places prmation e LPOI (examination regulation rs in ee (1 major) Mathematic	ns for teaching-degree progra S (2016) ematics (2016)		ubsequent semester	
 Additio 150 h Teachin Referre Module Master' Master'	ad ng cycl d to in s degru 's degru 's degru	e E E E E E E E E E E E E E	ns for teaching-degree progra s (2016) ematics (2016) al Physics (2016)	ammes)	ubsequent semester	
 Additio 150 h Teachin Referre Module Master Master Master	nal inf ad ad ad ad ad ad ad ad ad ad ad ad ad	e EPOI (examination regulation rs in ee (1 major) Mathematic ee (1 major) Mathematic ee (1 major) Mathematic	s (2016) ematics (2016) al Physics (2016) nal Mathematics (201	ammes) 6)		
 Additio 150 h Teachin Referre Master' Master' Master' Master'	ad ad ad ad ad ad ad ad ad ad ad ad ad a	e Places prmation e LPO I (examination regulation rs in ee (1 major) Mathematic ee (1 major) Economathe ee (1 major) Mathematic ee (1 major) Computatio	s (2016) ematics (2016) al Physics (2016) nal Mathematics (201 MINT Teacher Educat	ammes) 6) ion PLUS, Elite Netw	ork Bavaria (ENB) (20	
 Additio 150 h Teachir Referre Master' Master' Master' Master' Supple	ad ad ad ad ad ad ad ad ad ad ad ad ad a	e E E E E E E E E E E E E E	s (2016) ematics (2016) al Physics (2016) nal Mathematics (201 MINT Teacher Educat Education PLUS, Elite	ammes) 6) ion PLUS, Elite Netw Network Bavaria (EN	ork Bavaria (ENB) (20	
 Additio 150 h Teachin Referre Module Master' Master' Master' Master' Master' Master' Master' Master' Master' Master' Master' Master' Master'	ad ad ad ad ad ad ad ad ad ad ad ad ad a	e LPO I (examination regulation rs in ee (1 major) Mathematic ee (1 major) Economathe ee (1 major) Computatio ning degree Gymnasium y course MINT Teacher E ee (1 major) Computatio ee (1 major) Computatio ee (1 major) Computatio ee (1 major) Mathematic	s (2016) ematics (2016) al Physics (2016) nal Mathematics (201 MINT Teacher Educat Education PLUS, Elite nal Mathematics (201 s (2019)	ammes) 6) ion PLUS, Elite Netw Network Bavaria (EN 9)	ork Bavaria (ENB) (20 B) (2016)	016)
 Additio 150 h Teachin Referre Master Master Master Master Master Master Master Master Master	ad ad ad ad ad ag cycl ad to in a appea a s degre a s de	e LPO I (examination regulation res in ee (1 major) Mathematic ee (1 major) Economathe ee (1 major) Mathematic ee (1 major) Mathematic ee (1 major) Computation ing degree Gymnasium y course MINT Teacher E ee (1 major) Computatio	s (2016) ematics (2016) al Physics (2016) nal Mathematics (201 MINT Teacher Educat Education PLUS, Elite nal Mathematics (201 s (2019) MINT Teacher Educat	6) ion PLUS, Elite Netw Network Bavaria (EN 9) ion PLUS, Elite Netw	ork Bavaria (ENB) (20 B) (2016)	016)

Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025)

Module title					Abbreviation		
Seminar in Optimization 10-M=SOPT-161-mod				91			
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathema			natics)	s) Institute of Mathematics			
ECTS Method of grading			Only after succ. compl. of module(s)				
5 numerical grade							
Duration Module level Other prerequisites							
1 semester graduate							
Contents							
A modern topic in optimisation.							
		ning outcomes					
		-		nia. Thia includes as		hur at unin a af	
		able to elaborate a co the available literature,					
Course	S (type, n	umber of weekly contact hour	s, language — if other than Ger	man)			
S (2)							
		t in: German and/or En	=				
		essment (type, scope, lang	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether	
		le for bonus)					
		o minutes) ssessment: German or	English				
		ffered: In the semester		offered and in the su	ıbsequent semester		
Allocat							
Additio	nal inf	ormation					
Worklo	ad						
150 h							
Teachir	ng cycl	e					
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)			
				····· ···)			
Module	appea	urs in					
		ee (1 major) Mathemati	(2016)				
	-	ee (1 major) Economath					
	-	ee (1 major) Mathemati					
	-	ee (1 major) Computatio	•	6)			
	-	ning degree Gymnasiun	-		ork Bavaria (ENB) (20	016)	
		y course MINT Teacher					
Master's degree (1 major) Computational Mathematics (2019)							
	Master's degree (1 major) Mathematics (2019)						
	-	ning degree Gymnasiun	-	on PLUS, Elite Netwo	ork Bavaria (ENB) (20	020)	
		y course MINT Teacher					
Master	Master's degree (1 major) Mathematical Physics (2020)						
Master	Master's degree (1 major) Economathematics (2021)						
Master	Master's degree (1 major) Computational Mathematics (2022)						
Master's degree (1 major) Mathematics (2022)							
Master's wi	Master's with 1 major Mathematical Physics (2020) JMU Würzburg • generated 19-Apr-2025 • exam. reg. da- ta record Master (120 ECTS) Mathematische Physik - 2020 page 138 / 283						



Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

Master's with 1 major Mathematical Physics (2020)

Module title					Abbreviation		
Seminar in Statistics 10-M=SSTA-161-m01						01	
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathema		atics)	Institute of Mathem	atics			
ECTS Method of grading			Only after succ. compl. of module(s)				
5 numerical grade							
Duration Module level Other prerequisites							
1 semester graduate							
Contents							
A mode	ern topi	ic in statistics.					
Basic k the con	nowled Itents o	d previous knowledge: dge of stochastics is requ of the module "Stochasti ge may also be helpful; o	cs 2" is also recomme	ended. Depending or	n the content of the o		
Intende	ed lear	ning outcomes					
		able to elaborate a cont the available literature, p					
Course	S (type, r	number of weekly contact hours,	language — if other than Ge	rman)			
S (2) Module	e taugh	t in: German and/or Eng	lish				
		sessment (type, scope, langua	_	examination offered — if no	t every semester, informati	on on whether	
		le for bonus)	-		·		
-	talk (60 to 120 minutes)						
-	-	ssessment: German or E ffered: In the semester in	-	offered and in the cu	ibcoquent comester		
Allocat	-			onered and in the st	ibsequent semester		
πιισται							
Additio	nal inf	ormation					
Auuitio	ilat illi						
Worklo							
150 h	au						
Teachi	ig cyci	e					
Referre		LPO I (examination regulation	s for teaching-degree progra	ammes)			
Module	 Module appears in						
Master's degree (1 major) Mathematics (2016)							
Master's degree (1 major) Economathematics (2016)							
Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
		ry course MINT Teacher E				(010)	
		ee (1 major) Mathematic			_, (_0_0)		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
Master's degree (1 major) Mathematical Physics (2020)							
Master's wi	ith 1 majo	r Mathematical Physics (2020)	-	• generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 140 / 281	

Master's degree (1 major) Economathematics (2021)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

Master's degree (1 major) Economathematics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's degree (1 major) Economathematics (2024)

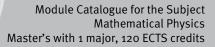
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Mathematical Data Science (2025)

Master's degree (1 major) Economathematics (2025)

Module title					Abbreviation			
Seminar in Non-linear Analysis					10-M=SNLA-161-mc)1		
Module coordinator				Module offered by				
Dean of Studies Mathematik (Mathema		atics)	Institute of Mathem	atics				
ECTS Method of grading			Only after succ. compl. of module(s)					
5								
Duratio		Module level	Other prerequisites	Other prerequisites				
1 seme		graduate						
Contents								
		ic in non-linear analysis.	_					
	- ni topi	ic in non-tinear analysis.						
		d previous knowledge:						
		the content, basic and commended to consult t		from different areas	of analysis is require	ed. In case of		
		ning outcomes			1 11 1			
		able to elaborate a con the available literature,						
		number of weekly contact hours,						
	S (type, f	fumber of weekly contact nours,		illidi)				
S (2) Module	e taugh	t in: German and/or Eng	lish					
		sessment (type, scope, langu	1	examination offered — if no	t every semester informat	ion on whether		
		le for bonus)	age in other than definally,		every semester, mornat	ion on whether		
talk (60	0 to 120	o minutes)						
Langua	ige of a	ssessment: German or E						
	-	ffered: In the semester i	n which the course is	offered and in the su	ibsequent semester			
Allocat	ion of _l	olaces						
Additio	nal inf	ormation	_					
Worklo	ad							
150 h								
Teachi	ng cycl	e						
Referre	d to in	LPO I (examination regulation	ns for teaching-degree progra	immes)				
Module	Module appears in							
		ee (1 major) Mathematic	s (2016)					
Master's degree (1 major) Economathematics (2016)								
Master's degree (1 major) Mathematical Physics (2016)								
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)								
		ry course MINT Teacher B		Network Bavaria (EN	B) (2016)			
	-	ee (1 major) Mathematic	-					
		hing degree Gymnasium				020)		
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)								
Master's degree (1 major) Mathematical Physics (2020)								
Master's degree (1 major) Economathematics (2021)								
Master's w	ith 1 majo	r Mathematical Physics (2020)	-	9 generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 142 / 281		



Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

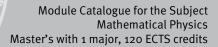
Module title					Abbreviation		
					10-M=SAMA-192-m	01	
Module	coord	inator		Module offered by			
Dean of Studies Mathematik (Mathema			atics)	Institute of Mathematics			
ECTS Method of grading			Only after succ. compl. of module(s)				
5		rical grade					
Duratio		Module level	Other prerequisites				
1 semes		graduate					
Contents							
		ic in applied mathematic					
A mode	mitop	ic in applied mathematic	.5.				
Recom	nende	d previous knowledge:					
		the content, basic and a			of applied mathema	itics is requi-	
		doubt, it is recommend	ed to consult the lect	urer.			
Intende	ed lear	ning outcomes					
		able to elaborate a cont					
· · · · ·		the available literature,			ate in a scientific dis	cussion.	
	S (type, r	number of weekly contact hours,	language — if other than Ge	rman)			
S (2)							
		t in: German and/or Eng					
		sessment (type, scope, langu- le for bonus)	age — if other than German,	examination offered — if no	t every semester, informat	ion on whether	
		o minutes)					
		ssessment: German or E		cc 1 1 1 1			
		ffered: in the semester i	n which the course is	offered and in the su	ibsequent semester		
Allocation of places							
Additio	nal inf	ormation					
Worklo	ad						
150 h							
Teachir	ıg cycl	e					
Referre	d to in	LPOI (examination regulation	s for teaching-degree progra	ammes)			
				(inite3)			
Module	annea	ars in					
			nal Mathematics (201	<u></u>			
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)							
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
		ry course MINT Teacher E					
		ee (1 major) Mathematic		-			
	-	ee (1 major) Economathe					
	-	ee (1 major) Computation		2)			
Master's degree (1 major) Mathematics (2022)							
Master's degree (1 major) Mathematical Physics (2022)							
Master's degree (1 major) Economathematics (2022)							
Master's wi	th 1 majo	r Mathematical Physics (2020)	_	9 generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 144 / 281	

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025) Master's degree (1 major) Economathematics (2025)

Module	title				Abbreviation
Learnin	g by Te	eaching 1			10-M=ELT1-192-m01
Module	coord	inator		Module offered by	
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	(not) s	successfully completed		•	
Duratio		Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts	5			
		tutorial or study group in	the Bachelor's progr	amme under guidan	ce of the respective lecturer.
		ning outcomes			
		-	co in tooching univo	rcity mathematics	le/She knows basic didactical
		can apply them in practic		isity mathematics. n	ley she knows basic didacticat
		umber of weekly contact hours, l	-	man)	
Ü (2)	(t)pe,				
	l of acc	accment (type scope langua		wamination offered — if no	t every semester, information on whether
		le for bonus)	ge — Il other than German, e	zammation onered — If no	it every semester, mormation on whether
Assess	ment o	f tutoring activities by su	pervising lecturers or	exercise supervisor	s (1 to 2 teaching units)
		ssessment: German		•	, <u> </u>
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Applica	tion ar	d selection with the teac	hing coordinator for	mathematics	
Worklo					
150 h					
Teachir	ng cycl	a			
	13 0 0 0	•			
Poforro	d to in	LPOI (examination regulations	for toaching dogroe progra	mmoc)	
Kelelle			s for teaching-degree progra	mmes)	
Module		ve in			
	•••	ee (1 major) Computation	al Mathematics (201	2)	
	-	ee (1 major) Computation))	
	-	ee (1 major) Mathematica			
	-	ee (1 major) Economathe			
Master'	s degre	ee (1 major) Computation	al Mathematics (202	2)	
Master'	s degre	ee (1 major) Mathematics	(2022)		
Master'	s degre	ee (1 major) Mathematica	ll Physics (2022)		
		ee (1 major) Economathe			
		gram Mathematics (2023)			
	-	ee (1 major) Computation		4)	
	-	ee (1 major) Mathematics			
	-	ee (1 major) Economathe			
master	s degre	ee (1 major) Economathe	matics (2025)		





Subfield Physics

(8 ECTS credits)



Module Group General Theory of Physics

(ECTS credits)

Module title Abbreviation						
Quantu	m Mec	hanics II			11-QM2-161-m01	
Module	coord	nator		Module offered by		
Managi and Ast	-	ctor of the Institute of ics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	numerical grade					
Duratio	n	Module level	Other prerequisites			
1 semester undergraduate						
course for QM: for QM: 1. Histo 2. Singl 3. Princ 4. Spin 5. Appro 6. Appro 7. Seco 8. Poter 9. Gene 10. Can 11. Chai	Contents The contents of this lecture build upon and will be chosen in accordance with the topics of the Bachelor's degree course "Quantum Mechanics I". Topics might include:					
		ing outcomes				
The stu most of	dents a	acquire in-depth knowl eoretical Master's degr n of this course is high	ee courses in Astrophy			
_		umber of weekly contact hours	<u> </u>	rman)		
V (4) + F		uniber of weekly contact hour.		many		
		t in: German or English				
Method	l of ass	essment (type, scope, lang	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
module is	creditab	le for bonus)				
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester						
Allocati	ion of p	laces				
Additio	nal info	ormation				
Master's wit	th 1 major	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 149 / 281

Workload

240 h

Teaching cycle

R

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

Module appears in

Master's degree (1 major) Mathematics (2016)

Master's degree (1 major) Physics (2016)

Master's degree (1 major) Nanostructure Technology (2016)

Master's degree (1 major) Mathematical Physics (2016)

Master's degree (1 major) Computational Mathematics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Nanostructure Technology (2020)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Quantum Technology (2021)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	title				Abbreviation
Theoret	tical Qu	uantum Optics			11-TQO-221-m01
Module	coord	inator		Module offered by	
Managing Director of the Institute of Theoret and Astrophysics			eoretical Physics	Faculty of Physics a	nd Astronomy
ECTS Method of grading Only after succ. compl. of module(s)					
8	numei	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate			
Conten	ts				
2. Intera 3. Mast 4. Cohe 5. Cohe 6. Photo	action o er equa rence a rent lig on stati	cal atom-field interaction of atoms with quantized l ation and open systems and interference effects wht propagation in resona istics and correlations otics of many-body system	light fields and dress Int media	ed-atom model	
		ning outcomes			
cal leve In-dept tistics a Lindbla on effec	l. Knov h unde Ind cor d supe cts in re	vledge of density matrix f rstanding of quantum pro relations. Knowledge of t roperators. Understandir	ormalism for quantu operties of light and t he theory of open sys ng and modeling the nowledge of coopera	m systems and the re their experimental si stems and master eq role of coherence an	with atoms at the microscopi- elated mathematical concepts. gnatures, including photon sta- juation description involving d interference in light propagati- body systems: super- and subra-
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) + F Module		t in: German or English			
			ge — if other than German, e	examination offered — if no	t every semester, information on whether
b) oral e c) oral e d) proje e) prese If a writ stead ta of asses nation o Langua	 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 				
Allocati					· · · · · · · · · · · · · · · · · · ·
Additio	nal info	ormation			
Worklo	ad				
240 h					

Teaching cycle

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

Module appears in

Master's degree (1 major) Mathematical Physics (2016)

Master's degree (1 major) Physics (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Quantum Technology (2021)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Module	title				Abbreviation
Theory	of Rela	tivity			11-RTT-161-m01
Module	coord	inator		Module offered by	
Managing Director of the Institute of Theoretical Phy and Astrophysics			eoretical Physics	Faculty of Physics a	nd Astronomy
ECTS Method of grading Only after succ. compl. of module(s)					
6	numerical grade				
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate			
Conten	ts				
 2. Differ 3. Brief 4. Elem 5. Electron 6. Field 7. Stella 	rential Summ ents of rodyna equati ar equil	al Foundations forms ary of the special relativit differential geometry mics as an example of a ons of the fundamental s librium and other astroph to cosmology	relativistic gauge the structure of general re		
		ning outcomes			
main to electroo to simp	pics in dynami le mod	clude modern formulatio cs as a gauge theory and els of stellar equilibrium	n on the basis of diff general relativity are and are introduced t	erential forms. Furth e emphasised. The st o basic elements of	cepts of general relativity. The ermore, the similarities between tudents learn to apply the theory cosmology.
		umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (3) + F Module		t in: German or English			
			ge — if other than German, e	examination offered — if no	t every semester, information on whether
b) oral e c) oral e d) proje e) prese If a writ stead ta of asses nation o	a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest.				
		ssessment: German and/ ffered: In the semester in		offered and in the su	Ibsequent semester
Allocati					
	•				
Additio	nal info	ormation			
Workloa	ad				
180 h					
Teachin	ig cycle	9			

Module appears in

Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	e title				Abbreviation
Renorm	nalizati	on Group Methods in Fie	ld Theory		11-RMFT-161-m01
Module	e coord	inator		Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics			eoretical Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
"Renorn equatic fermior 1. Wilso 2. Path 3. Beth 4. RG fl 5. Comp mation	malisat ons anc on's RG integra e-Salpe ow equ parisor)	ion Group and Critical Ph l its relation to diagramm ns in the context of funct als of interacting fermions eter equation lations for the one-particl	enomena" (11-CRP). atic perturbation exp ional renormalisation 5 e and two-particle ve	It focuses on the diagonansions. This is of p n groups. An outline ertex	up (RG) as covered in the course grammatic formulation of RG flow articular relevance for interacting of the course might be: h as the random phase approxi-
Intende	ed learı	ning outcomes			
ledge s	erves a		he examination of pl		any-particle systems. This know- uperconductivity, charge and
-		umber of weekly contact hours, la		man)	
V (4) + Module		t in: German or English			
			ge — if other than German, e	examination offered — if no	t every semester, information on whether
 b) oral e c) oral e d) proje e) prese lf a writ stead ta of asse nation e Langua 	 module is creditable for bonus) a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 				
Allocat					
Additio	nal inf	ormation			
Worklo	ad				
240 h					

Teaching cycle

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

Module appears in

Master's degree (1 major) Physics (2016)

Master's degree (1 major) Mathematical Physics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title					Abbreviation	
		nplex Systems			11-PKS-161-m01	
Module	coord	nator		Module offered by		
Managi and Ast		ctor of the Institute of T ics	heoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading Only after succ. compl. of module(s)						
6	6 numerical grade					
Duratio	n	Module level	Other prerequisites	;		
1 semes	ster	graduate				
Content	ts					
 2. Introd 3. Entrod 4. Phas 5. Unive 6. Spin 	ductior py pro- e trans ersality glasse		equilibriumt st			
-		ning outcomes				
The stur derstan underst search	dents a iding of tanding activiti	acquire in-depth knowle f cooperative phenomer g of the concepts of entr es in different areas of p	na in complex many-p opy, entropy producti physics of complex sys	article systems. The on and universality. stems.	main focus includes	a thorough
		umber of weekly contact hours,	language — if other than Ge	rman)		
V (2) + F Module		t in: German or English	_			
		essment (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
b) oral e c) oral e d) proje e) prese If a writ stead ta of asses nation o Langua	examin examin ect repo entatio ten exa ake the ssment date at ge of a	nination (approx. 90 to ation of one candidate ation in groups (groups ort (approx. 8 to 10 page n/talk (approx. 30 minu mination was chosen a form of an oral examin is changed, the lecture the latest. ssessment: German and ffered: In the semester i	each (approx. 30 minu of 2, approx. 30 minu es) or tes). s method of assessm ation of one candidate er must inform student	ites per candidate) of ent, this may be char e each or an oral exai ts about this by four y	nged and assessmer mination in groups. I weeks prior to the or	If the method riginal exami-
Allocati	ion of p	laces				
Additio	nal info	ormation				
Worklo	ad					
180 h						
Teachin	ng cycl	9				
Referre	d to in	LPO I (examination regulatio	ns for teaching-degree progra	ammes)		
Master's wit	th 1 major	Mathematical Physics (2020)	-	egenerated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 157 / 281

Module appears in

Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

	e			Abbreviation
Advanced 1	heory of Quantum Comput	ing and Quantum Info	ormation	11-QIC-201-m01
Module cod	ordinator		Module offered by	l
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics a	and Astronomy	
ECTS Me	thod of grading	Only after succ. cor	npl. of module(s)	
6 nur	numerical grade			
Duration				
1 semester graduate				
Contents				
 3. Composi 4. Entangle 5. Quantum 6. Quantum 	n theory seen from the pers te systems and the Schmid ment measures n operations, POVMs, and th n gates and quantum comp s of the theory of decoheren	t decomposition ne theorems of Kraus uters		
	arning outcomes			
				ndamental mathematical con- m computing arising from deco-
	e, number of weekly contact hours,	language — if other than Ge	rman)	
V (3) + R (1)		language — if other than Ge	rman)	
V (3) + R (1) Module tau Method of a	ght in: German or English			ot every semester, information on whether
V (3) + R (1) Module tau Method of a) written e b) oral exar c) oral exar d) project r e) presenta If a written stead take of assessm nation date Language o	ght in: German or English assessment (type, scope, langua itable for bonus) xamination (approx. 90 to a nination of one candidate e nination in groups (groups o eport (approx. 8 to 10 pages tion/talk (approx. 30 minut examination was chosen as the form of an oral examina	age — if other than German, L20 minutes) or each (approx. 30 minu of 2, approx. 30 minu s) or es). 5 method of assessm tion of one candidate r must inform student /or English	examination offered — if no utes) or utes per candidate) o ent, this may be cha e each or an oral exa ts about this by four	r nged and assessment may in- mination in groups. If the methoo weeks prior to the original exami-
V (3) + R (1) Module tau Method of a) written e b) oral exar c) oral exar d) project r e) presenta If a written stead take of assessm nation date Language o	ght in: German or English assessment (type, scope, langua itable for bonus) xamination (approx. 90 to a nination of one candidate e nination in groups (groups of eport (approx. 8 to 10 pages tion/talk (approx. 30 minut examination was chosen as the form of an oral examina ent is changed, the lecture at the latest. of assessment: German and t offered: In the semester in	age — if other than German, L20 minutes) or each (approx. 30 minu of 2, approx. 30 minu s) or es). 5 method of assessm tion of one candidate r must inform student /or English	examination offered — if no utes) or utes per candidate) o ent, this may be cha e each or an oral exa ts about this by four	r nged and assessment may in- mination in groups. If the methoc weeks prior to the original exami-
V (3) + R (1) Module tau Method of a module is cred a) written e b) oral exar c) oral exar d) project re e) presenta If a written stead take of assessm nation date Language of Assessmen	ght in: German or English assessment (type, scope, langua itable for bonus) xamination (approx. 90 to a nination of one candidate e nination in groups (groups of eport (approx. 8 to 10 pages tion/talk (approx. 30 minut examination was chosen as the form of an oral examina ent is changed, the lecture at the latest. of assessment: German and t offered: In the semester in	age — if other than German, L20 minutes) or each (approx. 30 minu of 2, approx. 30 minu s) or es). 5 method of assessm tion of one candidate r must inform student /or English	examination offered — if no utes) or utes per candidate) o ent, this may be cha e each or an oral exa ts about this by four	r nged and assessment may in- mination in groups. If the methoo weeks prior to the original exami-
V (3) + R (1) Module tau Method of a module is cred a) written e b) oral exar c) oral exar d) project re e) presenta If a written stead take of assessm nation date Language of Assessmen Allocation of	ght in: German or English assessment (type, scope, langua itable for bonus) xamination (approx. 90 to a nination of one candidate e nination in groups (groups of eport (approx. 8 to 10 pages tion/talk (approx. 30 minut examination was chosen as the form of an oral examina ent is changed, the lecture at the latest. of assessment: German and t offered: In the semester in	age — if other than German, L20 minutes) or each (approx. 30 minu of 2, approx. 30 minu s) or es). 5 method of assessm tion of one candidate r must inform student /or English	examination offered — if no utes) or utes per candidate) o ent, this may be cha e each or an oral exa ts about this by four	r nged and assessment may in- mination in groups. If the methoo weeks prior to the original exami-
V (3) + R (1) Module tau Method of a module is cred a) written e b) oral exar c) oral exar d) project re e) presenta If a written stead take of assessm nation date Language of Assessmen Allocation of	ght in: German or English assessment (type, scope, langua itable for bonus) xamination (approx. 90 to 1 nination of one candidate e nination in groups (groups of eport (approx. 8 to 10 pages tion/talk (approx. 30 minut examination was chosen as the form of an oral examina ent is changed, the lecture e at the latest. of assessment: German and t offered: In the semester in of places	age — if other than German, L20 minutes) or each (approx. 30 minu of 2, approx. 30 minu s) or es). 5 method of assessm tion of one candidate r must inform student /or English	examination offered — if no utes) or utes per candidate) o ent, this may be cha e each or an oral exa ts about this by four	r nged and assessment may in- mination in groups. If the methoo weeks prior to the original exami-
V (3) + R (1) Module tau Method of a module is cred a) written e b) oral exar c) oral exar d) project re e) presenta If a written stead take of assessmen nation date Language of Assessmen Allocation of 	ght in: German or English assessment (type, scope, langua itable for bonus) xamination (approx. 90 to 1 nination of one candidate e nination in groups (groups of eport (approx. 8 to 10 pages tion/talk (approx. 30 minut examination was chosen as the form of an oral examina ent is changed, the lecture e at the latest. of assessment: German and t offered: In the semester in of places	age — if other than German, L20 minutes) or each (approx. 30 minu of 2, approx. 30 minu s) or es). 5 method of assessm tion of one candidate r must inform student /or English	examination offered — if no utes) or utes per candidate) o ent, this may be cha e each or an oral exa ts about this by four	r nged and assessment may in- mination in groups. If the methoo weeks prior to the original exami

Module appears in

Master's degree (1 major) Nanostructure Technology (2020)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Quantum Technology (2021)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title					Abbreviation	
Black H	loles				11-SLQ-232-m01	
Module	e coord	inator		Module offered by		
Managi and Ast		ector of the Institute of ⁻ sics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	ECTS Method of grading Only after succ. c			ompl. of module(s)		
6	nume	rical grade				
Duration Module level Other prerequisites						
1 semester graduate						
Contents						
 Vacu kelst catio Gravi Chars ADM Black PART 2 Spin Black 	um sol ein coc n and (itationa ged an formal k hole t - Astro and m k hole (ical solutions utions of Einstein's equ ordinates, Kruskal exter Carter-Penrose diagram al collapse - the Oppenl d rotating black holes - ism - energy and angula thermodynamics physical observations of ass measurements of b electromagnetism al waves and their meas	nsion and eternal black neimer-Snyder solution Cauchy horizons, ergo ar momentum of black holes lack holes	k holes, the Penrose n		
1. Intro 2. Deriv 3. Hawl 4. The " 5. Firew	ductior vation o king's o 'hologr vall, fuz	ntum aspects of black h n to QFT on curved spac of Hawking radiation original formulation of t aphy of information" - i zzball, complementarity and the factorization p	etime: Rindler spaceti he information parado nformation paradox ir • - possible resolutions	ox o AdS/CFT, the Page c		
Intende	ed lear	ning outcomes				
ons in t Througl connec	the field h this c tion wi	ays a bridging role joini ds of Astronomy, Astrop ourse, the students wil th research directions i entioned directions and	physics, General Relati l gain sufficient comm n this area. This in turr	ivity, String Theory ar ands over the applic n will motivate them	d Gauge/Gravity Du ations of general rel to pursue careers as	ality. ativity in
Course	S (type, r	number of weekly contact hours	, language — if other than Ge	rman)		
V (3) + Module		t in: German or English				
		sessment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
b) oral e c) oral e d) proje e) prese If a writ stead ta of asse nation	examir examin ect repo entatio tten exa ake the ssmen date at	mination (approx. 90 to nation of one candidate ation in groups (groups ort (approx. 8 to 10 page n/talk (approx. 30 minu amination was chosen a e form of an oral examin t is changed, the lecture the latest.	each (approx. 30 minu of 2, approx. 30 minu es) or utes). as method of assessm ation of one candidate er must inform studen	ites per candidate) of ent, this may be char e each or an oral exa	nged and assessmen mination in groups. weeks prior to the or	If the method
waster s wi	ur i majo	mathematical Physics (2020)	-	• generated 19-Apr-2025 • exa r (120 ECTS) Mathematische P	-	page 101 / 281

Language of assessment: German and/or English

Assessment offered: In the semester in which the course is offered and in the subsequent semester

Allocation of places

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Additional information

Workload

180 h

Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2016)

Master's degree (1 major) Mathematical Physics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

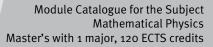
Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title					Abbreviation	
Astroph	nysics				11-APM-242-m01	
Module	coord	inator		Module offered by		
Managing Director of the Institute of Theoretical P and Astrophysics			eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading Only after succ. co			Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Content	ts					
Telesco Medium	pes an 1, Mole	onomy, Coordinates and d Detectors, Stellar Struc ecular Clouds, Structure c luclei, Large-Scale Struct	cture and Atmospher of the Milky Way, the	es, Stellar Evolution	and their End Stages	s, Interstellar
Intende	d learı	ning outcomes				
thods a	nd inst	as achieved a deepened truments of astrophysica asses in the context of th	l research. He/She is	able to interpret ast		
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Gei	rman)		
V (2) + F Module		t in: German or English				
		sessment (type, scope, langua	ge — if other than German,	examination offered — if no	t every semester, informati	ion on whether
		le for bonus)				
b) oral e c) oral e d) proje e) prese If a writ stead ta of asses nation o Langua	examin examin ect repo entatio ten exa ake the ssmen date at ge of a	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups o ort (approx. 8 to 10 pages n/talk (approx. 30 minut amination was chosen as form of an oral examina t is changed, the lecturer the latest. ssessment: German and, ffered: In the semester in	ach (approx. 30 minu of 2, approx. 30 minu of or es). method of assessme tion of one candidate must inform student /or English	tes per candidate) or ent, this may be char e each or an oral exar s about this by four v	nged and assessmer mination in groups. weeks prior to the or	If the method riginal exami-
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Approva	al from	examination committee	required.			
Worklo	ad					
180 h						
Teachin	ıg cycl	e				
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
Module						
	-	ee (1 major) Physics (201 ee (1 major) Mathematica				
Master's wit	th 1 majoı	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 163 / 281

Julius-Maximilians-UNIVERSITÄT WÜRZBURG



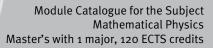
Master's degree (1 major) Physics (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023)

Module	title				Abbreviation	
Atmosp	heric F	Physics			11-ATP-242-m01	
Module	coord	inator		Module offered by		
Managing Director of the Institute of Theoretical Physic and Astrophysics			eoretical Physics	s Faculty of Physics and Astronomy		
ECTS Method of grading Only after succ. compl. of module(s)						
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Conten	ts					
mics. R and Rui	adiativ naway.	e transfer and radiative b	alance. Fluid mecha ic and magnetic field	nics. Greenhouse eff	l composition and thermodyna- ect. Climate Models: Equilibrium rerplanetary medium. Meteorites,	
Intende	d lear	ning outcomes				
ar-Earth ration o	space f exop	. They are able to use the	e acquired knowledge	e in the planning of s	ne Earth's atmosphere and ne- pace missions and in the explo- restrial climate and interpret the	
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Gei	rman)		
V (2) + I Module		t in: German or English				
Method	l of ass	essment (type, scope, langua	ge — if other than German,	examination offered — if no	t every semester, information on whether	
module is	creditab	le for bonus)				
b) oral e c) oral e d) proje e) prese lf a writ stead ta of asses nation o Langua Assessi	examin examin ect repo entatio ten exa ake the ssmen date at ge of a ment o	form of an oral examinat t is changed, the lecturer the latest. ssessment: German and/ ffered: In the semester in	ach (approx. 30 minu of 2, approx. 30 minu) or es). method of assessmu tion of one candidate must inform student [/] or English	tes per candidate) or ent, this may be char e each or an oral exar is about this by four v	nged and assessment may in- mination in groups. If the method weeks prior to the original exami-	
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
180 h						
Teachir	ig cycl	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	immes)		
Module						
Master'	s degre	ee (1 major) Physics (2010	6)			

Master's with 1 major Mathematical Physics (2020)

JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Master (120 ECTS) Mathematische Physik - 2020

Julius-Maximilians-UNIVERSITÄT WÜRZBURG



Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Physics (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023)

	e title				Abbreviation	
Open Q	Juantu	m Systems			11-0QS-242-m01	
Module	e coord	inator		Module offered by	<u> </u>	
		ector of the Institute of T	heoretical Physics	Faculty of Physics a	nd Astronomy	
and As				, , , , , , , , , , , , , , , , , , , ,	,	
ECTS	ECTS Method of grading Only after succ. compl. of module(s)					
6	numerical grade					
Duratio	on	Module level	vel Other prerequisites			
1 semester graduate						
Conten	ts					
density cesses	v matrix	theory, stochastic proc	esses in Hilbert space	e, non-Markovian pro	cesses, relativistic	quantum pro-
Intende	ed lear	ning outcomes				
develo	pment	of a theoretical understa	anding of quantum sy	stem coupled to thei	r environment	
Course	S (type, r	number of weekly contact hours,	, language — if other than Ge	rman)		
V (3) +	R (1)					
Module	e taugh	t in: German or English				
		sessment (type, scope, langu vle for bonus)	age — if other than German,	examination offered — if no	t every semester, informa	tion on whether
d) proje e) pres If a writ	examin ect repo entatio tten exa	nation of one candidate nation in groups (groups ort (approx. 8 to 10 page n/talk (approx. 30 minu amination was chosen a e form of an oral examina	es) or ites). is method of assessm	ites per candidate) of ent, this may be chai	nged and assessme	
d) proje e) press lf a writ stead t of asse nation Langua Assess	examin ect repo entatio tten exa ake the ssmen date at age of a ment o	ation in groups (groups ort (approx. 8 to 10 page in/talk (approx. 30 minu amination was chosen a e form of an oral examina t is changed, the lecture the latest. ssessment: German and ffered: In the semester i	of 2, approx. 30 minutes) or lites). Is method of assessmation of one candidate er must inform studen d/or English	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
d) proje e) pres If a writ stead t of asse nation Langua	examin ect repo entatio tten exa ake the ssmen date at age of a ment o	ation in groups (groups ort (approx. 8 to 10 page in/talk (approx. 30 minu amination was chosen a e form of an oral examina t is changed, the lecture the latest. ssessment: German and ffered: In the semester i	of 2, approx. 30 minutes) or lites). Is method of assessmation of one candidate er must inform studen d/or English	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
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d) proje e) pres If a writ stead t of asse nation Langua Assess Allocat	examin ect repo entatio tten exa ake the ssmen date at ge of a ment o ion of p	ation in groups (groups ort (approx. 8 to 10 page on/talk (approx. 30 minu amination was chosen a e form of an oral examina t is changed, the lecture t the latest. ssessment: German and ffered: In the semester i places	of 2, approx. 30 minutes) or lites). Is method of assessmation of one candidate er must inform studen d/or English	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
d) proje e) pres If a writ stead t of asse nation Langua Assess Allocat	examin ect repo entatio tten exa ake the ssmen date at ge of a ment o ion of p	ation in groups (groups ort (approx. 8 to 10 page on/talk (approx. 30 minu amination was chosen a e form of an oral examina t is changed, the lecture t the latest. ssessment: German and ffered: In the semester i places	of 2, approx. 30 minutes) or lites). Is method of assessmation of one candidate er must inform studen d/or English	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
d) proje e) press If a writ stead to of assen nation Langua Assess Allocat 	examin ect repo entatio tten exa ake the ssmen date at ge of a ment o ion of p	ation in groups (groups ort (approx. 8 to 10 page on/talk (approx. 30 minu amination was chosen a e form of an oral examina t is changed, the lecture t the latest. ssessment: German and ffered: In the semester i places	of 2, approx. 30 minutes) or lites). Is method of assessmation of one candidate er must inform studen d/or English	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
d) proje e) pres If a writ stead to of assentiation Langua Assess Allocat Additio	examin ect repo entatio tten exa ake the ssmen date at ge of a ment o ion of J mal inf	ation in groups (groups ort (approx. 8 to 10 page on/talk (approx. 30 minu amination was chosen a e form of an oral examina t is changed, the lecture t the latest. Issessment: German and ffered: In the semester i places	of 2, approx. 30 minutes) or lites). Is method of assessmation of one candidate er must inform studen d/or English	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
d) proje e) press If a writ stead to of assen nation Langua Assess Allocat Additio 180 h	examin ect repo entatio tten exa ake the ssmen date at ge of a ment o ion of J mal inf	ation in groups (groups ort (approx. 8 to 10 page on/talk (approx. 30 minu amination was chosen a e form of an oral examina t is changed, the lecture t the latest. Issessment: German and ffered: In the semester i places	of 2, approx. 30 minutes) or lites). Is method of assessmation of one candidate er must inform studen d/or English	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
d) proje e) press If a writ stead to of assen nation Langua Assess Allocat Additio 180 h Teachin 	examin ect repo entatio iten exa ake the ssmen date at ge of a ment o ion of p mal inf ad	ation in groups (groups ort (approx. 8 to 10 page on/talk (approx. 30 minu amination was chosen a e form of an oral examina t is changed, the lecture t the latest. Issessment: German and ffered: In the semester i places	of 2, approx. 30 minues) or es) or ites). is method of assessm ation of one candidate er must inform studen d/or English in which the course is	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four offered and in the su	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
d) proje e) press If a writ stead to of assen nation Langua Assess Allocat Additio 180 h Teachin 	examin ect repo entatio iten exa ake the ssmen date at ge of a ment o ion of p mal inf ad	etion in groups (groups ort (approx. 8 to 10 page on/talk (approx. 30 minu amination was chosen a e form of an oral examina t is changed, the lecture t the latest. essessment: German and ffered: In the semester i places ormation	of 2, approx. 30 minues) or es) or ites). is method of assessm ation of one candidate er must inform studen d/or English in which the course is	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four offered and in the su	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
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d) proje e) press If a writ stead to of asse nation Langua Assess Allocat Morklo 180 h Teachin Referre Module	examin ect repo entatio tten exa ake the ssmen date at ge of a ment o ion of p mal inf ad ad ed to in	e LPOI (examination regulation e t t t t t t t t t t t t t	of 2, approx. 30 minutes) or lites). Is method of assessmation of one candidate er must inform studen d/or English in which the course is ns for teaching-degree progra	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four offered and in the su	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
d) proje e) press If a writ stead to of assen nation Langua Assess Allocat Additio 180 h Teachin Referre Master Master Master	examin ect repo entatio tten exa ake the ssmen date at ge of a ment o ion of p onal inf ad ed to in 's degr 's degr	ation in groups (groups ort (approx. 8 to 10 page on/talk (approx. 30 minu amination was chosen a e form of an oral examina- t is changed, the lecture t the latest. ssessment: German and ffered: In the semester i places ormation e LPO I (examination regulation ars in ee (1 major) Physics (20 ee (1 major) Mathematic	of 2, approx. 30 minutes) or ites). is method of assessmation of one candidate ar must inform studen d/or English in which the course is ns for teaching-degree progra 16) cal Physics (2016)	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four offered and in the su	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
d) proje e) press If a writ stead to of asse nation Langua Assess Allocat Worklo 180 h Teachin Referre Module Master Master Master	examin ect repo- entatio tten exa ake the ssmen date at ge of a ment o ion of j mal inf ad ed to in e appea 's degr 's degr	ation in groups (groups ort (approx. 8 to 10 page on/talk (approx. 30 minu amination was chosen a e form of an oral examina- t is changed, the lecture t the latest. Issessment: German and ffered: In the semester i places formation e e LPO I (examination regulation ars in ee (1 major) Physics (20 ee (1 major) Physics (20 ee (1 major) Physics (20	of 2, approx. 30 minutes) or ites). is method of assessm ation of one candidate er must inform studen d/or English in which the course is ns for teaching-degree progra 16) cal Physics (2016) 20)	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four offered and in the su	nged and assessme mination in groups. weeks prior to the c	If the method original exami
d) proje e) press If a writ stead to of asse nation Langua Assess Allocat Worklo 180 h Teachin Referre Module Master Master Master Master	examin ect repo- entatio ten exa ake the ssmen date at ge of a ment o ion of p mal inf ad ad ad ad ad ad ad ad ad ad ad ad ad	e LPOI (examination regulation e (1 major) Physics (20 e (1 major) Mathematic	of 2, approx. 30 minutes) or ites). is method of assessmation of one candidate ar must inform studen d/or English in which the course is ns for teaching-degree progra- 16) cal Physics (2016) 20) cal Physics (2020)	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four offered and in the su	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
d) proje e) press If a writ stead t of asse nation Langua Assess Allocat Additio Norklo 180 h Teachin Referre Master Master Master Master Master	examin ect repo entatio tten exa ake the ssmen date at ge of a ment o ion of j onal inf ad ed to in 's degr 's degr 's degr 's degr	e LPO I (examination regulation ee (1 major) Mathematic	of 2, approx. 30 minutes) or ites). is method of assessmation of one candidate ar must inform studen d/or English in which the course is ns for teaching-degree progra- 16) cal Physics (2016) 20) cal Physics (2020)	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four offered and in the su	nged and assessme mination in groups. weeks prior to the c	If the method original exami-
d) proje e) pres If a writ stead t of asse nation Langua Assess Allocat Worklo 180 h Teachin Referre Module Master Master Master Master Master exchan	examine ect repo- entatio tten exa ake the ssmen date at orge of a ment o ion of p onal inf ad ed to in e appea 's degr 's degr 's degr 's degr	e LPOI (examination regulation e (1 major) Physics (20 e (1 major) Mathematic	of 2, approx. 30 minutes) or ites). is method of assessm ation of one candidate er must inform studen d/or English in which the course is ns for teaching-degree progra 16) cal Physics (2016) 20) cal Physics (2020) cal Physics (2022)	ites per candidate) of ent, this may be char e each or an oral exa ts about this by four offered and in the su	nged and assessme mination in groups. weeks prior to the c ubsequent semeste	If the method original exami



Module Group Theoretical Solid State Physics

(ECTS credits)

Module title					Abbreviation	
Theoret	ical So	lid State Physics			11-TFK-161-m01	
Module	coordi	inator		Module offered by		
Managi and Ast		ector of the Institute of T ics	heoretical Physics	Faculty of Physics and Astronomy		
ECTS Method of grading Only after succ. compl. of module(s)						
8 numerical grade						
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Content	ts					
bus whi A possi 1 Band pologic 2 Electr ry, rand 3 Applic	ich cou ble syll structu al insu on-elec om pha cation o	of this two-term course of ald alternatively be offer abus may be: re (Sommerfeld theory lators (TIs), bulk-surfac ctron interactions in sol ase approximation (RPA of mean field theory and of superconductivity	red as "Quantum Many of metals, Bloch theor e correspondence, ger ids (path integral meth A), density functional t	v Body Physics" (11-Q em, k.p approach an neral properties of TI: nod for weakly intera heory)	VTP). d effective Hamilton 5)	ians for to-
		ning outcomes				
sics, wh cepts an sics" an Courses V (4) + F Module Method module is a) writte	nich are nd the nd "Qua s (type, n R (2) taught l of ass creditabl en exar	e-semester lecture, the e addressed in classica methods of description antum Mechanics". umber of weekly contact hours t in: German or English eessment (type, scope, langu- le for bonus) nination (approx. 90 to ation of one candidate	l textbooks, and there . The course builds up , language — if other than Ger uage — if other than German, 120 minutes) or	by advance their kno on the courses "Expo man) examination offered — if no	wledge of the under erimental Condense	lying con- d Matter Phy-
c) oral e d) proje e) prese If a writ stead ta of asses nation o Langua	 b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 					If the method
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
240 h						
Teachin	ig cycle	9				
Master's wit	th 1 major	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	_	page 169 / 281

Module appears in

module appears in	
Master's degree (1 major) Mathematics (2016)	
Master's degree (1 major) Physics (2016)	
Master's degree (1 major) Nanostructure Technology (2016)	
Master's degree (1 major) Mathematical Physics (2016)	
Master's degree (1 major) Computational Mathematics (2016)	
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)	
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)	
Master's degree (1 major) Computational Mathematics (2019)	
Master's degree (1 major) Mathematics (2019)	
Master's degree (1 major) Nanostructure Technology (2020)	
Master's degree (1 major) Physics (2020)	
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	
Master's degree (1 major) Mathematical Physics (2020)	
Master's degree (1 major) Quantum Technology (2021)	
Master's degree (1 major) Computational Mathematics (2022)	
Master's degree (1 major) Mathematics (2022)	
Master's degree (1 major) Mathematical Physics (2022)	
exchange program Physics (2023)	
Master's degree (1 major) Computational Mathematics (2024)	
Master's degree (1 major) Mathematics (2024)	
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)	
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)	

Module coordinator Module offered by Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) and Astrophysics Immerical grade Immerical grade Duration Module level Other prerequisites 1 semester graduate Immerical Superconductivity (Bogoliubov-de Gennes equations, effective field theory, Anderson-Higgs description of the Meissner effect) 6. Unconventional superconductors (G. Copper-oxide high-Tc superconductors) Immerical seperconductors (G. Copper-oxide high-Tc superconductors) 7. Green's function methods and Peynman diagrammatic technique B. 8. The Kondo Effect (Anderson's "poor mans scaling", renormalization group) Intended learning outcomes During the two-semester lecture, the students acquire a basic understanding of many topics of Solid-State Physics' and "Quantum Mechanics". Courses Uppe, number of weekly contact hours, language – if other than Geman. V (a) + R (a) Module taught in: German or English Method of assessment (type, scape, language – if other than Geman, examination offered – if not every senester, information on whether module is coefficiate for hours) 0 value taught in: German or English	Module title				Abbreviation		
Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics 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 - Contents - - A continuation of the first semester (scription of the Meissner effect) - 6. Unconventional superconductors (e.G. copper-oxide high-Tc superconductors) - 7. Green's function methods and Feynman diagrammatic technique 8. 8. The Kondo Effect (Anderson's "poor mans scaling", renormalization group) Intended learning outcomes During the two-semester lecture, the students acquire a basic understanding of many topics of Solid-State Physics, which are addressed in classical textbooks, and thereby advance their knowledge of the underlying concepts and the methods of description. The course builds upon the courses "Experimental Condensed Matter Physics" and "Quantum Mechanics". Courses (type, number of weeky contact hours, language – if other than Geman, examination offered – if not every senester, information on whether module is certilable for honus) a) written examination (approx. 9 to 120 minutes) or o) oral examination in groups (groups of 2, approx. 30 minutes) or o) oral examination in groups	Theoretical Solid State Physics 2					11-TFK2-161-m01	
and Astrophysics Only after succ. compl. of module(s) B numerical grade Duration Module level Other prerequisites 1 semester graduate Contents A continuation of the first semester (1:1-TF() might be the following syllabus: S. Advanced topics of the theory of superconductivity (Bogoliubov-de Gennes equations, effective field theory, Anderson-Higgs description of the Meissner effect) 6. Unconventional superconductors (e.G. copper-oxide high-Tc superconductors) . Green's function methods and Feynman diagrammatic technique 8. The Kondo Effect (Anderson's "poor mans scaling", renormalization group) Intended learning outcomes During the two-semester lecture, the students acquire a basic understanding of many topics of Solid-State Physics, which are addressed in classical textbooks, and thereby advance their knowledge of the underlying concepts and the methods of description. The course builds upon the courses "Experimental Condensed Matter Physics" and "Quantum Mechanics". Courses (type, number of weekly contact hours, language – if other than German. V (4) + R (2) Module taught in: German or English Method of assessment (type, scope, language – if other than German, examination of ne candidate each (approx. 30 minutes) or b) or e) paresentation/talk (approx. 30 minutes) or t) or al examination in groups (gr	Module coordinator				Module offered by		
8 numerical grade	Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics					nd Astronomy	
Duration Module level Other prerequisites 1 semester graduate Contents A continuation of the first semester (11-TFK) might be the following syllabus: S. Advanced topics of the theory of superconductivity (Bogoliubox-de Gennes equations, effective field theory, Anderson-Higgs description of the Meissner effect) 6. Unconventional superconductors (e.G. copper-oxide high-Tc superconductors) 7. Green's function methods and Feynman diagrammatic technique 8. The Kondo Effect (Anderson's "poor mans scaling", renormalization group) Intended learning outcomes During the two-semester lecture, the students acquire a basic understanding of many topics of Solid-State Physics, which are addressed in classical textbooks, and thereby advance their knowledge of the underlying concepts and the methods of description. The course builds upon the courses "Experimental Condensed Matter Physics," and "Quantum Mechanics". Courses (type, number of weekly contact hours, language – if other than German) V (4) + R (2) Module taught in: German or English Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) a) written examination of one candidate each (approx. 30 minutes) or c) or al examination in groups (groups 0 z, approx. 30 minutes) or c) or ale examination in groups. If the method of assessment	ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
1 semester graduate	8	nume	rical grade				
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During the two-semester lecture, the students acquire a basic understanding of many topics of Solid-State Phy- sics, which are addressed in classical textbooks, and thereby advance their knowledge of the underlying con- cepts and the methods of description. The course builds upon the courses "Experimental Condensed Matter Phy- sics" and "Quantum Mechanics". Courses (type, number of weekly contact hours, language – if other than German) V (A) + R (2) Module taught in: German or English Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) a) written examination (approx. 9 to 120 minutes) or b) oral examination in groups (groups of 2, approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes) or c) oral examination f an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester Additional information 			· · · · · ·	inalis scaling, lenon	nalization group)		
V (4) + R (2) Module taught in: German or English Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester Allocation of places Morkload 240 h Teaching cycle 	sics, wh cepts a	nich are nd the	e addressed in classical t methods of description.	extbooks, and there	by advance their kno	wledge of the underlying con-	
Module taught in: German or English Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus) a) written examination (approx. 9 ot 0 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester Allocation of places Morkload 240 h Teaching cycle			umber of weekly contact hours, la	anguage — if other than Ger	man)		
module is creditable for bonus) a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester Allocation of places			t in: German or English				
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Additional information Workload 240 h Teaching cycle	 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester. 						
Workload 240 h Teaching cycle	Allocation of places						
Workload 240 h Teaching cycle							
240 h Teaching cycle	Additional information						
240 h Teaching cycle							
Teaching cycle	Workload						
-	240 h						
Referred to in LPO I (examination regulations for teaching-degree programmes)	Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)							
	Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					

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Module appears in

Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title				Abbreviation		
Phenomenology and Theory of Superconductivity					11-PTS-201-m01	
Module coordinator				Module offered by		
	ng Dire	ector of the Institute of Ap ector of the Institute of Th sics		Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Basic Properties of Superconductors and their Applications, Development of technological platforms, Methods of material science for calculating temperature profiles in superconductors. Overview of the phenomenology of conventional and unconventional superconductivity. Review of BCS theory and its applicability for different types of superconductors. Extension of Ginzburg-Landau theory to a quantum field theory formalism using Feynman diagrams and functional integrals. Theoretical formalism of Ward identities and response functions. Goldstone modes, phase fluctuations, and coupling to the electromagnetic field. Interpretation of the Meissner effect in terms of the Higgs mechanism. Interplay of magnetism and conventional/unconventional superconductivity. Discussion of current research topics and perspective on room-temperature superconductivity.						
Intende	ed learr	ning outcomes				
Acquisition of basic knowledge about superconductivity as a macroscopic quantum phenomenon. Profound un- derstanding of unconventional superconductivity and its interplay with magnetism in the context of current rese- arch. Knowledge of BCS mean-field theory, the quantum-field theory methods necessary to extend BCS theory, as well as the Meissner effect and the Higgs mechanism. Basic understanding of unconventional superconduc- tors and their fascinating connection with competing magnetic phases.						
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)		
V (3) + I Module		t in: German or English				
Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)						
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 						
Allocation of places						
Additional information						
Worklo	ad					
180 h						

Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2020)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Quantum Technology (2021)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title Abbreviation					
Topological Effects in Solid State Physics				11-TEFK-201-m01	
Module coordinator			Module offered by	<u> </u>	
Managing Director of the Institute of Theoretical Physics and Astrophysics			Faculty of Physics a	and Astronomy	
	od of grading	Only after succ. con	npl. of module(s)		
8 nume	rical grade				
Duration	Module level	Other prerequisites			
1 semester	graduate				
Contents					
 2. Mathematical basics of topology 3. Time-reversal symmetry 4. Hall conductance and Chern numbers 5. Bulk-boundary correspondence 6. Graphene (as a topological insulator) 7. Quantum Spin Hall insulators 8. Z2 invariants 9. Topological superconductors Intended learning outcomes					
stems. Ability Astronomy at	to connect their knowled Würzburg University.	ge with different reso	earch activities at the	sics related to solid state sy- e Department of Physics and	
	umber of weekly contact hours, l	anguage — if other than Ge	rman)		
V (4) + R (1) Module taugh	t in: German or English				
	sessment (type, scope, langua	ge — if other than German,	examination offered — if no	ot every semester, information on whether	
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 					
Allocation of places					
Additional information					
Workload					
240 h					
Teaching cycl	e				

Module appears in

Master's degree (1 major) Nanostructure Technology (2020)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Quantum Technology (2021)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title					Abbreviation	
Field Theory in Solid State Physics				11-FFK-201-m01		
Module coordinator			Module offered by			
	Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics					
ECTS		od of grading	Only after succ. con	npl. of module(s)		
8		rical grade				
Duratio		Module level	Other prerequisites	;		
1 seme	ster	graduate				
Conten	ts		-			
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						
		sional systems and bos	onization			
		ning outcomes	faurantum field theory	, in a man valativistia	and the Ability to at	
ties of F	ermi li	ledge of the methods o quids (and bosonic sys understanding the effe	tems) beyond the one	-particle picture. Acq	uisition of methods	which are es-
Course	S (type, n	umber of weekly contact hours	, language — if other than Ge	rman)		
V (4) + I						
		t in: German or English				
		s essment (type, scope, lang le for bonus)	uage — If other than German,	examination offered — if no	it every semester, informat	ion on whether
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 						
Allocation of places						
Additional information						
Worklo	ad					
240 h						
Teachir	ng cycl	e				
Master's wi	th 1 major	Mathematical Physics (2020)	-	• generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 177 / 281

Module appears in

Master's degree (1 major) Nanostructure Technology (2020)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Quantum Technology (2021)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title					Abbreviation		
Selected Topics of Theoretical Solid State Physics 11-AKTF-201-m01							
Module coordinator			Module offered by				
-	Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics						
ECTS Method of grading		Only after succ. con	ıpl. of module(s)				
6	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semes	ster	graduate					
Content	ts						
ments t	o bring	selected topics of conde the students in touch w quantum matter.					
Intende	ed learr	ning outcomes					
theoret	ical poi	earn how to describe cor int of view. This happens sover of these students t	on the basis of anal	vtical and numerical	methods. Therefore,		
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Gei	rman)			
V (3) + F Module		t in: German or English					
		essment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, information	on on whether	
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 							
Allocation of places							
Additio	nal info	ormation					
Worklo	ad						
180 h							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module							
	-	ee (1 major) Nanostructu					
Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
		Mathematical Physics (2020)	JMU Würzburg •	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Ph	m. reg. da-	D2O) page 179 / 281	

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Mathematical Physics (2022) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Сотри	Module title Abbreviation				Abbreviation	
Computational Materials Science (DFT))		11-CMS-161-m01	
Module coordinator				Module offered by		
		ector of the Institute of Th	neoretical Physics	Faculty of Physics a	and Astronomy	
	trophys		, F			
ECTS	Metho	od of grading	Only after succ. cor	npl. of module(s)		
8		rical grade				
Duratio	on	Module level	Other prerequisites	5		
1 seme		graduate				
Conten		ctional theory (DFT)				
 3. Numerical evaluation of topological invariants 4. Hartree-Fock and static mean-field theory 5. Many-body methods for solid state physics 6. Anderson impurity model (AIM) and Kondo physics 7. Dynamical mean-field theory (DMFT) 8. DFT + DMFT methods for realistic modeling of solids 9. Strongly correlated electrons Intended learning outcomes Aside from the theoretical discussion of these topics, the students carry out hands-on exercises from the CIP pool. The participants are introduced to the use of DFT software packages such as VASP or Wienzk and to the construction of maximally localised Wannier functions through the projection of DFT results on atom orbitals with the software wannier90. Furthermore, the students learn how to construct many-particle solutions of AIM and observe border cases such as the Kondo regime. Impurity solvers such as exact diagonalisation or continuous-time quantum Monte Carlo are utilised to solve the self consistency equations of dynamic molecular field theory						
	(DMFT). These steps are necessary to reach the peak of the lecture: a DFT-DMFT calculation of a strongly correla- ted transition metal oxide such as SrVO ₃ .					
Courses (type, number of weekly contact hours, language – if other than German) V (4) + R (2)						
V (4) +	R (2)	metal oxide such as SrV number of weekly contact hours,	03.	lecture: a DFT-DMFT		
V (4) + Module	R (2) e taugh	metal oxide such as SrV number of weekly contact hours, t in: German or English	O3. language — if other than Ge	lecture: a DFT-DMFT	calculation of a strongly correla-	
V (4) + Module Metho e	R (2) e taugh d of ass	metal oxide such as SrV number of weekly contact hours, t in: German or English	O3. language — if other than Ge	lecture: a DFT-DMFT		
V (4) + Module Method module is a) writt b) oral c) oral d) proje e) press If a writ stead t of asse nation Langua	R (2) e taugh d of ass s creditab ten exa examin ect repo- centatio tten exa cake the essmen date at age of a	metal oxide such as SrV number of weekly contact hours, t in: German or English sessment (type, scope, langua le for bonus) mination (approx. 90 to a nation of one candidate e ation in groups (groups o ort (approx. 8 to 10 pages n/talk (approx. 30 minut amination was chosen as form of an oral examina	O3. language — if other than German, age — if other than German, 120 minutes) or each (approx. 30 minutes) of 2, approx. 30 minutes) or tes). a method of assessess tion of one candidater must inform studen /or English	lecture: a DFT-DMFT rman) examination offered — if no utes) or utes per candidate) o ent, this may be cha e each or an oral exa ts about this by four	calculation of a strongly correla- ot every semester, information on whether r nged and assessment may in- mination in groups. If the method weeks prior to the original exami-	
V (4) + Module module is a) writt b) oral c) oral d) proje e) pres If a writ stead t of asse nation Langua Assess	R (2) e taugh d of ass s creditab ten exa examin ect repo- centatio tten exa cake the essmen date at age of a	metal oxide such as SrV number of weekly contact hours, t in: German or English sessment (type, scope, langua le for bonus) mination (approx. 90 to a nation of one candidate e ation in groups (groups of ort (approx. 8 to 10 pages n/talk (approx. 30 minut amination was chosen as form of an oral examina t is changed, the lecturen the latest. ssessment: German and ffered: In the semester in	O3. language — if other than German, age — if other than German, 120 minutes) or each (approx. 30 minutes) of 2, approx. 30 minutes) or tes). a method of assessess tion of one candidater must inform studen /or English	lecture: a DFT-DMFT rman) examination offered — if no utes) or utes per candidate) o ent, this may be cha e each or an oral exa ts about this by four	calculation of a strongly correla- ot every semester, information on whether r nged and assessment may in- mination in groups. If the method weeks prior to the original exami-	
V (4) + Module module is a) writt b) oral c) oral d) proje e) pres If a writ stead t of asse nation Langua Assess	R (2) e taugh d of ass s creditab ten exal examin ect repo- sentatio tten exa take the essmen date at age of a sment o	metal oxide such as SrV number of weekly contact hours, t in: German or English sessment (type, scope, langua le for bonus) mination (approx. 90 to a nation of one candidate e ation in groups (groups of ort (approx. 8 to 10 pages n/talk (approx. 30 minut amination was chosen as form of an oral examina t is changed, the lecturen the latest. ssessment: German and ffered: In the semester in	O3. language — if other than German, age — if other than German, 120 minutes) or each (approx. 30 minutes) of 2, approx. 30 minutes) or tes). a method of assessess tion of one candidater must inform studen /or English	lecture: a DFT-DMFT rman) examination offered — if no utes) or utes per candidate) o ent, this may be cha e each or an oral exa ts about this by four	calculation of a strongly correla- ot every semester, information on whether r nged and assessment may in- mination in groups. If the method weeks prior to the original exami-	
V (4) + Module module is a) writt b) oral c) oral d) proje e) pres If a writ stead t of asse nation Langua Assess Allocat	R (2) e taugh d of ass s creditab ten exal examin ect repo- sentatio tten exa take the essmen date at age of a sment o tion of p	metal oxide such as SrV number of weekly contact hours, t in: German or English sessment (type, scope, langua le for bonus) mination (approx. 90 to a nation of one candidate e ation in groups (groups of ort (approx. 8 to 10 pages n/talk (approx. 30 minut amination was chosen as form of an oral examina t is changed, the lecturen the latest. ssessment: German and ffered: In the semester in	O3. language — if other than German, age — if other than German, 120 minutes) or each (approx. 30 minutes) of 2, approx. 30 minutes) or tes). a method of assessess tion of one candidater must inform studen /or English	lecture: a DFT-DMFT rman) examination offered — if no utes) or utes per candidate) o ent, this may be cha e each or an oral exa ts about this by four	calculation of a strongly correla- ot every semester, information on whether r nged and assessment may in- mination in groups. If the method weeks prior to the original exami-	

Workload

240 h

Teaching cycle

R

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

Module appears in

Master's degree (1 major) Mathematics (2016)

Master's degree (1 major) Physics (2016)

Master's degree (1 major) Mathematical Physics (2016)

Master's degree (1 major) Computational Mathematics (2016)

Master's degree (1 major) Functional Materials (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Functional Materials (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Functional Materials (2025)

Module	e title				Abbreviation		
Conformal Field Theory 11-KFT-161-m01					11-KFT-161-m01		
Module	e coord	inator		Module offered by			
Manag and As		ector of the Institute of Th	neoretical Physics	Faculty of Physics a	and Astronomy		
ECTS Method of grading Only after succ. compl. of module(s)							
6 numerical grade							
Duratio		Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	its						
Contents Conformal field theory (CFT) was developed in the 1980s and found immediate application in string theory and two-dimensional statistical mechanics, where critical exponents and correlation functions for many models (Ising, tricritical Ising, 3-state Potts, etc.) could be exactly calculated. The physical idea is that the principle of scale invariance is elevated from a global to a local invariance, which, for reasons of consistency, amounts to invariance under conformal transformations. This, in turn, yields a rich and fascinating mathematical structure for two dimensional systems (either two space dimensions or one time and one space dimension). CFT has become relevant to many interesting areas of condensed matter physics, including Abelian and non-Abelian bosonisation, quantised Hall states (where the bulk wave function is described in terms of conformal correlators, and the edge in terms of 1+1 dimensional CFTs), the two-channel Kondo effect, fractional topological insulators, and in particular fault-tolerant topological quantum computers involving non-Abelian anyons (Ising and Fibonacci anyons, for example, owe their names to the fusion rules of the associated conformal fields.) A potential syllabus for the first term of the course is: o. Introduction (scale and conformal invariance, critical exponents, the transverse Ising model at the self-dual point) 1. Conformal theories in D a gebra, conformal group, conformal algebra in 2D, constraints on correlation functions) 2. Conformal theories in D=2 (primary fields and correlation functions, quantum field theory, canonical quantisation and Polyakov's theorem, time ordering and functional integration, the free boson and vertex operators, conformal Ward identities) 3. Central charge and Virasoro algebra (central charge, the Schwarzian derivative, free fermion, (Abelian) bosonisation, mode expansions and Virasoro algebra, cylinder geometry and Casimir effect, in- and out-states, highest weight states, descendant fields and operator product expansions, co							
comple also ac primari	etion of quire b ily addı ing acq	"Quantum Mechanics II" pasic knowledge of critica ressed to students of The quainted with a sophistica	(11-QM2) is the only Il phenomena, quant oretical Physics and	prerequisite to take um field theory and aims to increase the	f conformal field theory. As the part in this course, the students functional integrals. The course is ir general level of knowledge by nany subdisciplines of Condensed		

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

V (3) + R (1)

Module taught in: German or English

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

a) written examination (approx. 90 to 120 minutes) or

b) oral examination of one candidate each (approx. 30 minutes) or

c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or

d) project report (approx. 8 to 10 pages) or

Master's with 1 major Mathematical Physics (2020)

JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Master (120 ECTS) Mathematische Physik - 2020

e) presentation/talk (approx. 30 minutes).

If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.

Language of assessment: German and/or English

Assessment offered: In the semester in which the course is offered and in the subsequent semester

Allocation of places

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Additional information

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Workload

180 h

Teaching cycle

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

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Module appears in

Master's degree (1 major) Mathematics (2016)

Master's degree (1 major) Physics (2016)

Master's degree (1 major) Mathematical Physics (2016)

Master's degree (1 major) Computational Mathematics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Module title				Abbreviation	
Conformal Field Theory 2					11-KFT2-161-m01
Module coordinator				Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics			eoretical Physics	Faculty of Physics a	ind 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 seme	ster	graduate			
Conten	ts				
lid-on-s au-Ginz del, suj 6. Free 7. Free ons of the toru 8. Free ral, S1/	solid m zburg d percon bosons fermion Virasor us, Jacc bosons Z2 orbi	odels), correlation functi escription of minimal mo formal models) s and fermions (mode ex ns on the torus (operator o algebra, modular group obi theta function identiti s on the torus (Lagrangia ifold, Gaussian and Askh	ons of the critical Isir odels, modified Could pansions, twist fields implementation of th and fermionic spins es) n formulation of the p	ng model, fusion rule omb gas method and s, fermionic zero mod ne partition function, structures, Virasoro d partition function, fer	a state Potts model, restricted so- es and Verlinde algebra, Land- l its application to the Ising mo- des and fermion parity) , vacuum energies, representati- characters, critical Ising model on rmionisation, orbifolds in gene- l and orbifold theories, marginal
operato	ors, the	space of c=1 theories)			
Intende	ed lear	ning outcomes			
also ac primari becomi Matter	quire b ly addr ing acq Physics	asic knowledge of critica ressed to students of The uainted with a sophistica s.	l phenomena, quant oretical Physics and ated subdiscipline wi	um field theory and f aims to increase the th applications in m	part in this course, the students functional integrals. The course is ir general level of knowledge by any subdisciplines of Condensed
		number of weekly contact hours, l	anguage — if other than Ger	rman)	
V (3) + Module		t in: German or English			
Method	d of ass	Sessment (type, scope, langua	ge — if other than German, o	examination offered — if no	ot every semester, information on whether
 module is creditable for bonus) a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 					
	παι ΠΠ	ormation			

Workload

180 h

Teaching cycle

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

Module appears in

Master's degree (1 major) Mathematics (2016)

Master's degree (1 major) Physics (2016)

Master's degree (1 major) Mathematical Physics (2016)

Master's degree (1 major) Computational Mathematics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title Abbreviation					
Particle Ph	ysics (Standard Model)			11-TPSM-201-m01	
Module co	ordinator	Module offered by			
Managing I	Directors of the Institute of A	pplied Physics and	Faculty of Physics a	nd Astronomy	
-	e of Theoretical Physics and				
	TS Method of grading Only after succ. compl. of module(s)				
	merical grade				
Duration	Module level	Other prerequisites			
1 semester Contents	graduate	Approval from exam	ination committee re	equired.	
Theoretical description of the Standard Model Electroweak symmetry breaking through the Higgs mechanism parity Violation Bhabha scattering Z-Line Shape and forward / reverse asymmetry Higgs production and decay Experimental setup and results of key experiments to test the Standard Model and for determining its parame- ters Search for the Higgs boson Intended learning outcomes Students know the theoretical fundamental laws of the standard model of particle and the key experiments that have established and confirmed the standard model. They have basic knowledge in order to interpret experimen- tal or theoretical results in the framework of the standard model can and knows its significance and limitations. Courses (type, number of weekly contact hours, language — if other than German)					
V (3) + R (1)					
	ught in: German or English				
	assessment (type, scope, languag litable for bonus)	ge — If other than German, (examination offered — if no	t every semester, information on whether	
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English 					
Allocation	nt offered: In the semester in of places	which the course is			
Additional	information				
Workload					
180 h					
Teaching c	ycle				

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

Module appears in

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)

Module title			Abbreviation			
Renormalization Group and Critical Phenomena				11-CRP-161-m01		
Module coordinator			Module offered by			
Managing Director of the Institute of Theoretical Physics and Astrophysics				Faculty of Physics a	ind Astronomy	
ECTS		od of grading	Only after succ. con	npl. of module(s)		
6		rical grade		•		
Duratio		Module level	Other prerequisites	;		
1 seme	ster	graduate				
Conten	ts					
4. Pertu 5. Low- 6. Conf	n field f concep irbation dimens ormal s	theory t of the renormalization n-theoretical renormali sional systems symmetry	n group (RG) Phase dia zation group	grams and fixed poir	its	
		ning outcomes				
(RG) in	Statist		ledge of the principles erstand the concept of			
Course	S (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
V (3) + I Module		t in: German or English				
Method	l of ass	essment (type, scope, lang	guage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
module is	creditab	le for bonus)				
b) oral of c) oral of d) project e) prese If a writ stead ta of asse nation of Langua	examin examin ect repo entatio ten exa ake the ssmen date at ge of a	ation in groups (group ort (approx. 8 to 10 pag n/talk (approx. 30 min amination was chosen form of an oral examin t is changed, the lectur the latest. ssessment: German ar	e each (approx. 30 minutes of 2, approx. 30 minutes) or utes). as method of assessmention of one candidate for must inform student	ites per candidate) o ent, this may be cha e each or an oral exa ts about this by four	nged and assessme mination in groups. weeks prior to the o	If the method riginal exami-
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
180 h						
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)		
Module	appea	ars in				
Master's wi	th 1 majoi	r Mathematical Physics (2020)	-	• generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 189 / 281

Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title				Abbreviation	
Bosonisation and Interactions in One Dimension					11-BWW-161-m01
Module	e coord	inator		Module offered by	
Managi and Ast	-	ector of the Institute of Th ics	eoretical Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
6	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
 1.Instability of Fermi systems in one dimension (1D) 2.Abelian bosonisation and Luttinger liquids (spinless fermions, correlation functions, models with spin, renormalization group, and the sine-Gordon model). The below mentioned topics will be presented in different years: 3.Interacting fermions on a lattice (Hubbard model, t/J model, transport properties) 4.Bethe ansatz 5.Spin-1/2 chains 6.Disordered systems 7.Non-abelian bosonisation and the WZW model (Kac-Moody algebras, Sugawara construction, Knizhnik-Zamo- 					
		ation, applications of the hing outcomes	e wzw model)		
					ctron systems and acquire the lisorder effects and transport in
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (3) + Module		t in: German or English			
		essment (type, scope, langua) le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 					
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Worklo	ad				
180 h					

Teaching cycle

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

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Module appears in

Master's degree (1 major) Mathematics (2016)

Master's degree (1 major) Physics (2016)

Master's degree (1 major) Mathematical Physics (2016)

Master's degree (1 major) Computational Mathematics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Introduction to Gauge/Gravity Duality Module offered by Module offered by Managing Director of the Institute of The Institute of Physics Faculty of Physics and Astronomy Gauge Offered by Module of grading Only after succ. compl. of module(s) ECTS Module level Only after succ. compl. of module(s) Buration Grading Only after succ. compl. of module(s) Module level Other prerequisites Duration Module level Other prerequisites Interactions Statistics of quantum field theory: 0 quantisation of the free field Interactions Renormalisation Group Sauge Fields Sonformal Symmetry Large N expansion Supersymmetry Supersymmetry Starge N expansion Supersymmetry Sauge N expansion Sauge	
Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics 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 Contents 1. Elements of quantum field theory: Quantisation of the free field Interactions Renormalisation Group Gauge Fields Conformal Symmetry Large N expansion Supersymmetry 2. Elements of gravity Manifolds, coordinate covariance and metric Riemann curvature Maximally symmetric spacetimes Black holes 3. Elements of string theory Open and closed strings 9. Strings in background fields 0. Open and closed strings 0. DeBranes	
Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics 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 Contents 1. Elements of quantum field theory: Quantisation of the free field Interactions Renormalisation Group Gauge Fields Conformal Symmetry Large N expansion Supersymmetry 2. Elements of gravity Manifolds, coordinate covariance and metric Riemann curvature Maximally symmetric spacetimes Black holes 3. Elements of string theory Open and closed strings	
ECTS Method of grading Only after succ. compl. of module(s) 8 numerical grade Duration Module level Other prerequisites 1 semester graduate Contents 1. Elements of quantum field theory: • Quantisation of the free field Interactions • Renormalisation Group Gauge Fields • Conformal Symmetry Large N expansion • Supersymmetry 2. Elements of gravity • Manifolds, coordinate covariance and metric Riemann curvature • Maximally symmetric spacetimes Black holes 3. Elements of string theory Open and closed strings • Strings in background fields Type IIB String Theory • D-Branes Delage	
Duration Module level Other prerequisites 1 semester graduate Contents Contents 1. Elements of quantum field theory: Quantisation of the free field Interactions Renormalisation Group Gauge Fields Conformal Symmetry Large N expansion Supersymmetry 2. Elements of gravity Manifolds, coordinate covariance and metric Riemann curvature Maximally symmetric spacetimes Black holes 3. Elements of string theory Open and closed strings Open and closed strings Strings in background fields Type IIB String Theory D-Branes	
1 semester graduate Contents 1. Elements of quantum field theory: • Quantisation of the free field • Interactions • Renormalisation Group • Gauge Fields • Conformal Symmetry • Large N expansion • Supersymmetry 2. Elements of gravity • Manifolds, coordinate covariance and metric • Riemann curvature • Maximally symmetric spacetimes • Black holes 3. Elements of string theory • Open and closed strings • Strings in background fields • Type IIB String Theory • D-Branes	
Contents 1. Elements of quantum field theory: • Quantisation of the free field • Interactions • Renormalisation Group • Gauge Fields • Conformal Symmetry • Large N expansion • Supersymmetry 2. Elements of gravity • Manifolds, coordinate covariance and metric • Riemann curvature • Maximally symmetric spacetimes • Black holes 3. Elements of string theory • Open and closed strings • Strings in background fields • Type IIB String Theory • D-Branes	
 Elements of quantum field theory: Quantisation of the free field Interactions Renormalisation Group Gauge Fields Conformal Symmetry Large N expansion Supersymmetry Elements of gravity Manifolds, coordinate covariance and metric Riemann curvature Maximally symmetric spacetimes Black holes Elements of string theory Open and closed strings Strings in background fields Type IIB String Theory D-Branes 	
 Quantisation of the free field Interactions Renormalisation Group Gauge Fields Conformal Symmetry Large N expansion Supersymmetry 2. Elements of gravity Manifolds, coordinate covariance and metric Riemann curvature Maximally symmetric spacetimes Black holes 3. Elements of string theory Open and closed strings Strings in background fields Type IIB String Theory D-Branes 	
 Statement of the correspondence Near-horizon limit of D3-Branes Field-operator correspondence Tests of the correspondence: Correlation functions Tests of the correspondence: Conformal anomaly Holographic principle 5. Extensions to non-conformal theories Holographic renormalisation group Holographic C-Theorem 6. Applications I: Thermo- and hydrodynamics Quantum field theory at finite temperature Black holes Holographic linear response formalism Transport coefficients: Shear viscosity and conductivities 7. Applications II: Condensed matter physics Finite charge density and Reissner-Nordström black holes Quantum critical behaviour Holographic superconductors Entanglement entropy 8. Applications III: Particle physics Gravity dual of confinement Gravity dual of chiral symmetry breaking Quark-gluon plasma 	193 / 281

Intended learning outcomes

The students acquire a thorough understanding of the foundations of gauge/gravity duality and the ability to carry out basic tests. Depending on the pre-existing knowledge and interests of the students, the module addresses a selection of the aforementioned topics. Knowledge of quantum mechanics and classical electrodynamics is a prerequisite for this course. Knowledge of quantum field theory and general relativity is useful, but not a prerequisite.

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

V (4) + R (2)

Module taught in: German or English

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

a) written examination (approx. 90 to 120 minutes) or

b) oral examination of one candidate each (approx. 30 minutes) or

c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or

d) project report (approx. 8 to 10 pages) or

e) presentation/talk (approx. 30 minutes).

If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.

Language of assessment: German and/or English

Assessment offered: In the semester in which the course is offered and in the subsequent semester

Allocation of places

--

Additional information

--

Workload

240 h

Teaching cycle

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

--

Module appears in

Master's degree (1 major) Mathematics (2016)

Master's degree (1 major) Physics (2016)

Master's degree (1 major) Mathematical Physics (2016)

Master's degree (1 major) Computational Mathematics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)



Master's degree (1 major) Mathematics (2024)



Module Group Astrophysics

(ECTS credits)

Module title			Abbreviation			
Cosmology					11-AKM-161-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Theoretical Physi and Astrophysics			heoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Content	ts					
matter,	primor	ace-time, Friedmannian dial nucleosynthesis, co actic medium, cosmolog	osmic microwave back			
Intende	d lear	ning outcomes				
	ate the	nave basic knowledge of em to observations. They stions.				
Courses	5 (type, n	umber of weekly contact hours,	language — if other than Ger	rman)		
V (3) + F Module	• •	t in: German or English				
		s essment (type, scope, langu le for bonus)	age — if other than German, o	examination offered — if no	t every semester, informati	on on whether
b) oral e c) oral e d) proje e) prese If a writ stead ta of asses nation o Langua	examin examin ect repo entatio ten exa ake the ssmen date at ge of a	nination (approx. 90 to ation of one candidate of ation in groups (groups ort (approx. 8 to 10 page n/talk (approx. 30 minu amination was chosen a form of an oral examina t is changed, the lecture the latest. ssessment: German and ffered: In the semester i	each (approx. 30 minu of 2, approx. 30 minu s) or tes). s method of assessme ation of one candidate r must inform student l/or English	tes per candidate) or ent, this may be char e each or an oral exar is about this by four v	nged and assessmer mination in groups. weeks prior to the or	If the method riginal exami-
Allocati						
Additio	nal info	ormation	_			
Workloa	ad					
180 h			_			
Teachin	ig cycl	e				
Referre	d to in	LPO I (examination regulation	ns for teaching-degree progra	mmes)		
		_	· · ·			
Module	appea	irs in				
Master'	s degre	ee (1 major) Mathematic ee (1 major) Physics (202 ee (1 major) Mathematic	16)			
	-	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa	m. reg. da-	page 197 / 281
			-	(120 ECTS) Mathematische Ph	-	

Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title					Abbreviation							
Theoretical Astrophysics				 11-AST-161-m01								
			l									
Module	e coord	inator		Module offered by								
Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics												
ECTS	Methe	od of grading	Only after succ. cor	npl. of module(s)								
6	nume	rical grade										
Duratio	on	Module level	Other prerequisites	6								
1 seme	ster	graduate										
Conten	ts											
		retical astrophysics suc jets, shock waves, radia			lack holes, superno	ovae, pulsars,						
Intende	ed lear	ning outcomes										
		basic processes and me	ethods of Theoretical	Astrophysics. Ability	to formulate theoret	ical models.						
		number of weekly contact hours,										
V (2) +												
		t in: German or English										
Method	d of ass	sessment (type, scope, langu ole for bonus)	age — if other than German,	examination offered — if no	t every semester, informat	ion on whether						
stead ta of asse nation Langua Assess	ake the ssmen date at ge of a ment o	e form of an oral examin t is changed, the lecture the latest. ssessment: German and ffered: In the semester i	ation of one candidate er must inform studen d/or English	e each or an oral exam ts about this by four v	nination in groups. weeks prior to the o	If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester						
Allocat	ion of p	places										
Additional information												
 Worklo	ad											
 Worklo 180 h	ad											
180 h												
180 h Teachii 	ng cycl	e	ns for teaching-degree progra	ammes)								
180 h Teachii 	ng cycl		ns for teaching-degree progra	ammes)								
180 h Teachin Referre	ng cycl ed to in	e LPO I (examination regulatio	ns for teaching-degree progra	ammes)								
180 h Teachin Referre Module	ng cycl ed to in e appea	e LPO I (examination regulatio ars in		ammes)								
180 h Teachin Referre Module Master	ng cycl ed to in e appea	e LPO I (examination regulatio	rs (2016)	ammes)								
180 h Teachin Referre Module Master Master	ng cycl ed to in e appea 's degr 's degr	e LPOI (examination regulatio ars in ee (1 major) Mathematic	rs (2016) 16)	ammes)								
180 h Teachin Referre Module Master Master Master Master	ng cycl ed to in e appea 's degr 's degr 's degr 's degr	e LPOI (examination regulatio ars in ee (1 major) Mathematic ee (1 major) Physics (20 ee (1 major) Mathematic ee (1 major) Computatio	:s (2016) 16) :al Physics (2016) nal Mathematics (201	.6)								
180 h Teachin Referre Master Master Master Master Master	ng cycl ed to in e appea 's degr 's degr 's degr 's degr 's teac	e LPO I (examination regulatio ars in ee (1 major) Mathematic ee (1 major) Physics (20 ee (1 major) Mathematic ee (1 major) Computatio hing degree Gymnasium	rs (2016) 16) ral Physics (2016) nal Mathematics (201 MINT Teacher Educat	.6) ion PLUS, Elite Netwo								
180 h Teachin Referre Master Master Master Master Supple	ng cycl ed to in e appea 's degr 's degr 's degr 's degr 's teac menta	e LPOI (examination regulatio ars in ee (1 major) Mathematic ee (1 major) Physics (20 ee (1 major) Mathematic ee (1 major) Computatio	s (2016) 16) al Physics (2016) nal Mathematics (201 MINT Teacher Educat Education PLUS, Elite	.6) ion PLUS, Elite Netwo	B) (2016)							

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title					Abbreviation
Introduction to Plasma Physics					11-EPP-161-m01
Module coordinator				Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics Faculty of Physics and Astronomy					and Astronomy
ECTS	<u> </u>	od of grading	Only after succ. cor	npl. of module(s)	
6	1	rical grade		•	
Duration Module level Other prerequisites					
1 seme	ster	graduate			
Conten	its				
transpo thin the celerat	ort equi e solar ion and	ations for energetic part wind, particle accelerati I transport in galaxies an	icles, properties of ma on via shock waves a	agnetic turbulence, p nd via interaction wi	elds, magnetohydrodynamics, propagation of solar particles w th plasma turbulence, particle liation.
	-	ning outcomes			
		have knowledge of the b			
	-	number of weekly contact hours,	language — if other than Ge	rman)	
V (2) + Module		t in: German or English			
		-	age — if other than German	examination offered — if no	ot every semester, information on whethe
		le for bonus)	age – Il other than German,		st every semester, mormation on whethe
e) pres If a writ stead t of asse nation Langua	entatio tten exa ake the essmen date at age of a	e form of an oral examina	tes) s method of assessm ation of one candidat r must inform studen d/or English	e each or an oral exa ts about this by four	nged and assessment may in- mination in groups. If the meth weeks prior to the original exai ubsequent semester
Allocat					
Additio	onal inf	ormation			
Worklo	ad				
180 h					
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regulatio	ns for teaching-degree progr	ammes)	
Module	e appea	ars in			
	-	ee (1 major) Physics (20	16)		
Master	's teac	ee (1 major) Mathematic hing degree Gymnasium ry course MINT Teacher I	al Physics (2016) MINT Teacher Educat		ork Bavaria (ENB) (2016) B) (2016)

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Module title				Abbreviation		
High Energy Astrophysics				11-APL-161-m01		
Module coordinator			Module offered by			
Managing Director of the Institute of Theoretical Physics and Astrophysics				Faculty of Physics a	and Astronomy	
ECTS		od of grading	Only after succ. con	npl. of module(s)		
6		rical grade		•		
Duratio	on	Module level	Other prerequisites	;		
1 semester graduate						
Conten	ts		-			
		esses, interaction of lig			sses, pair creation,	nuclear pro-
Intende	ed lear	ning outcomes				
		ains knowledge in funda adiative processes in as		gy Astrophysics, suc	h as particle acceler	ration and
Course	S (type, r	number of weekly contact hours,	language — if other than Ge	rman)		
V (3) + Module		t in: German or English				
Method	d of ass	sessment (type, scope, langu	age — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
module is	s creditab	le for bonus)				
d) proje e) prese If a writ stead ta of asse nation Langua	ect repo entatio tten exa ake the ssmen date at age of a	ation in groups (groups ort (approx. 8 to 10 page n/talk (approx. 30 minu amination was chosen a e form of an oral examin t is changed, the lecture the latest. ssessment: German and ffered: In the semester i	s) or tes). s method of assessm ation of one candidate r must inform studen l/or English	ent, this may be cha e each or an oral exa ts about this by four	nged and assessme mination in groups. weeks prior to the o	If the method riginal exami-
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
	_					
Worklo	ad					
180 h						
Teachi	ng cycl	e				
Referre	d to in	LPOI (examination regulatio	ns for teaching-degree progra	ammes)		
Module	e appea	urs in				
	-	ee (1 major) Mathematic				
	-	ee (1 major) Physics (20				
	-	ee (1 major) Mathematic	-			
	-	ee (1 major) Computatio ning degree Gymnasium			ork Bavaria (FNR) (a	016)
		r Mathematical Physics (2020)		• generated 19-Apr-2025 • example		page 203 / 281
nasiei S WI	iai i majo	mathematical Flipsics (2020)	-	(120 ECTS) Mathematische P	-	page 203 / 201

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title				Abbreviation	
Computational Astrophysics					11-NMA-161-m01
Module coordinator				Module offered by	
Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics			nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate			
Conten	ts				
rithms (Lattice-	(tree- a Boltzm	nd polynomial codes). Pa ann). Hyperbolic conserv	article-mesh methods vation laws (fluid dyn	s (particle-in-cell met amics, finite differer	eir applications. N-body algo- thods). Vlasow methods (e.g., nce method, Riemann solver, I). GPGPU programming (OPEN-
Intende	ed leari	ning outcomes			
sics wit	h the h		ions. They are especi		nd other subdisciplines of Phy- sing adequate strategies to ap-
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Gei	man)	
V (3) + I Module		t in: German or English			
Method	l of ass	essment (type, scope, langua	ge — if other than German,	examination offered — if no	t every semester, information on whether
module is	creditab	le for bonus)			
b) oral e c) oral e d) proje e) prese If a writ stead ta of asses nation o Langua Assessi	examin examin ect repo entatio ten exa ake the ssmen date at ge of a ment o	form of an oral examina t is changed, the lecturer the latest. ssessment: German and, ffered: In the semester in	ach (approx. 30 minu of 2, approx. 30 minu o) or es) method of assessme tion of one candidate must inform student /or English	tes per candidate) or ent, this may be char e each or an oral exar s about this by four y	nged and assessment may in- mination in groups. If the method weeks prior to the original exami-
Allocati	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
180 h					
Teachir	ng cycl	e			
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	irs in			
Master'	s degr	ee (1 major) Physics (201	6)		

Master's with 1 major Mathematical Physics (2020)

Master's degree (1 major) Mathematical Physics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)



Module Group Theoretical Elementary Particle Physics

(ECTS credits)

Module title					Abbreviation	
Quantum Field Theory I					11-QFT1-201-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Theoretical Pl and Astrophysics			eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading Only after succ. compl. of module(s)						
8	numer	ical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate	Approval from examination committee required.			
Content	ts					
 Lagra Field Asym Gaug Pertu Feynr Quar 	 Symmetries. Lagrange formalism for fields. Field quantisation. Asymptotic states, scattering theory and S-matrix Gauge principle and interaction. Perturbation theory. Feynman rules. Quantum elektrodynamical processees in Born approximation. Radiative corrections (optional) 					
		ing outcomes				
The students have mastered the principles and underlying mathematics of relativistic quantum field theories. They know how to use perturbation theory and how to apply Feynman rules. They are able to calculate basics processes in the framework of quantum electrodynamics in leading order. Moreover, they have a basic under- standing of radiative corrections and renormalisation.						
		umber of weekly contact hours, la	anguage — if other than Ger	man)		
V (4) + I Module		t in: German or English				
Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)						
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 						
Allocation of places						
Additional information						
Workload						
240 h						

Teaching cycle

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

Module appears in

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Module title					Abbreviation			
Quantu	m Field	l Theory II		11-QFT2-161-m01				
Module coordinator				Module offered by				
Managi and Ast	-	ector of the Institute of ⁻ sics	Theoretical Physics	Faculty of Physics and Astronomy				
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)				
8		rical grade						
Duratio		Module level	Other prerequisites	;				
1 seme	ster	graduate						
Conten	ts		- 1					
 Generating Functionals Path Integrals Renormalization Renormalization group Gauge theories Spontaneous Symmetry Breaking Effective Field Theory (optional) 								
		ning outcomes						
The stu red the	dents l princip	nave advanced knowled ples, especially of renor tum field theory by usi	malisation and gauge	theories. They are al				
Course	S (type, n	umber of weekly contact hours	s, language — if other than Ge	rman)				
V (4) + I Module		t in: German or English						
		s essment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether		
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 								
Allocation of places								
Additional information								
Workload								
240 h								
Teaching cycle								
Referred to in LPO I (examination regulations for teaching-degree programmes)								
·								
Master's wi	th 1 major	Mathematical Physics (2020)		• generated 19-Apr-2025 • exa (120 ECTS) Mathematische P		page 210 / 281		

Module appears in

Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title					Abbreviation	
Theoretical Elementary Particle Physics					11-TEP-161-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Theoretical Physic and Astrophysics			eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading Only after succ. compl. of module(s)						
8	numer	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Conten	ts					
 2. Symr 3. Quart 4. Quart 5. Princt 6. Gaugt 7. Spont 8. Elect 	 Fundamental particles and forces Symmetries and groups Quark model of hadrons Quark parton model and deep inelastic scattering Principles of quantum field theory Gauge theories Spontaneous symmetry breaking Electroweak standard model Quantum chrome dynamics 					
Intende	d learr	ning outcomes				
The students are familiar with the mathematical methods of Elementary Particle Physics. They understand the structure of the standard model based on symmetry principles and experimental observations. They know calculation methods for the processing of simple problems and processes of Elementary Particle Physics. Furthermore, they know the tests and limits of the standard model and the basics of extended theories.						
Courses	5 (type, n	umber of weekly contact hours, la	anguage — if other than Ger	man)		
V (4) + F Module		t in: German or English				
		e ssment (type, scope, languag le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 						
Allocation of places						
Additional information						
Workload						
240 h						

Teaching cycle

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

Module appears in

Master's degree (1 major) Mathematics (2016)

Master's degree (1 major) Physics (2016)

Master's degree (1 major) Mathematical Physics (2016)

Master's degree (1 major) Computational Mathematics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title					Abbreviation		
Selecte	d Topi	cs of Theoretical Element	ary Particle Physics		11-ATTP-161-m01		
Module coordinator				Module offered by			
Managing Director of the Institute of The and Astrophysics			eoretical Physics	Faculty of Physics a	nd Astronomy		
ECTS Method of grading Only after succ. com				npl. of module(s)			
6	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semes	ster	graduate		-			
Conten	ts						
A selection of topics from the following fields will be covered in different years: 1. Advanced techniques for precision calculations of scattering amplitudes 2. Phenomenology of particle accelerators 3. Higgs physics 4. Top quark physics							
Intende	d learr	ning outcomes					
neutrin	o physi		ulate extensions of t	he standard model. I	cle Physics, Higgs physics and Furthermore, they know how to cosmology.		
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)			
V (3) + I Module		t in: German or English					
			ge — if other than German, o	examination offered — if no	t every semester, information on whether		
module is creditable for bonus)							
b) oral e c) oral e d) proje e) prese lf a writ stead ta of asses nation o Langua Assessi	 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 						
Allocation of places							
Additional information							
Workload							
180 h							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master'	s degre	ee (1 major) Mathematics	(2016)				

Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title					Abbreviation			
String Theory 1 11-STRG1-171-m01								
Module coordinator			Module offered by					
Managing Director of the Institute of Theoretical Physic and Astrophysics				Faculty of Physics and Astronomy				
ECTS Method of grading Only after succ. compl. of module(s)								
8	nume	rical grade						
Duratio	n	Module level	Other prerequisites					
1 semes	ster	graduate						
Conten	ts							
Classical and quantum theory of the relativistic bosonic string, in particular the Nambu-Goto action and Polyakov action; quantisation of the closed bosonic string and emergent graviton; quantum Lorentz invariance and critical dimension; quantisation of the open bosonic string, D-Branes, Gauge Fields and Yang-Mills theories; relativistic conformal field theory, string path integral, BRST quantisation, string interactions, effective actions and gravity.								
Intende	ed learn	ning outcomes						
The students are familiar with classical and quantum theory of relativistic bosonic strings. They know the classi- cal actions for relativistic bosonic strings, the Nambu-Goto action and Polyakov action, they have quantised the bosonic string and understand the emergence of the massless graviton in the spectrum of the closed string. They have calculated Lorentz anomaly on quantum level to deduce the critical dimension of the bosonic string. They understand the boundary conditions for the open string and its connection to D-branes. They have knowledge of open string quantisation and of the spectrum of massless gauge fields, as well as of Yang-Mills fields for coinci- dent branes. They are familiar with relativistic conformal field theory, the string path integral, its BRST quantisa- tion and the calculation of string interactions. They understand the low-energy effective actions in target space and the emergence of Einstein gravity.								
_		umber of weekly contact hours		rman)				
V (4) + I Module		t in: German or English						
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)						ion on whether		
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester 								
Allocation of places								
Additional information								
Workload								
240 h								
Teaching cycle								
Master's wi	th 1 major	Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 216 / 281		

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

Module appears in

Master's degree (1 major) Physics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Module	e title				Abbreviation
String ⁻	Theory	2			11-STRG2-171-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)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	Contents				
mionic and mo A/B sup pe I sup ween th ge theo	fields a pre dim perstrir perstrir ne five pries, su	and representations of Cl ensions, the classical an ogs, the Gliozzi-Scherck-C og, heterotic string theori superstring theories as w upergravity and the AdS/	ifford algebra in dive d quantum version o Dlive projection and s es, anomaly cancella rell as their relation to	rse dimensions, a re f the Ramond-Nevea space-time supersym tion and restrictions o M theory in 11D, D-	string theory, the theory of fer- view of supersymmetry in two u-Schwarz superstring, type II nmetry in 10 dimensions, the ty- on gauge groups, dualities bet- Branes and supersymmetric gau-
		ning outcomes			
sions. 1 ry. They derstar of Glioz the lim dualitie miliar v supersy	The students are familiar with supersymmetrical string theory and M theory. They know the basic characteristics of bosonic string theory and fermionic field theory as well as the depiction of Clifford algebra in different dimensions. They have studied the aspects of supersymmetry in two or more dimensions relevant to superstring theory. They are acquainted with classical and quantum theory of the Ramon-Neveau-Schwarz superstring , they understand the deduction of type IIA/B string theories and the ensuring of space-time supersymmetry on the basis of Gliozzi-Scherk-Olive projection. They have gained insights into type I and heterotic superstring theory and into the limiting effects of anomaly freedom on the permitted gauge groups of these theories. They have studied the dualities between the five superstring theories and their connections to M theory in 11 dimensions. They are familiar with the properties of supersymmetric D-branes in type I and II superstring theories and the corresponding supersymmetric gauge theories as well as the supergravity effects in 10 and 11 dimensions and the connection to AdS/CFT correspondence.				
		umber of weekly contact hours, l	anguage — if other than Ger	rman)	
V (3) + Module	• •	t in: German or English			
Method	d of ass	sessment (type, scope, langua	ge — if other than German, d	examination offered — if no	t every semester, information on whether
 b) oral c) oral of d) project e) press If a write stead ta of asseent nation Langua Assess 	a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester Allocation of places				
Additio	nal inf	ormation			

Workload

180 h

Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Module	title				Abbreviation	
Models	Beyon	d the Standard Model of	Elementary Particle	Physics	11-BSM-161-m01	
Module	coord	inator		Module offered by		
Managi and Ast	-	ector of the Institute of Th ics	eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Conten	ts					
	of the rino ph		-	-	liders	
 P p ez m si 	 particle cosmology, 					
Intende	ed learn	ning outcomes				
neutrin	o physi		ulate extensions of t	he standard model. I	cle Physics, Higgs physics and Furthermore, they know how to cosmology	
		umber of weekly contact hours, l				
V (3) + I	R (1)	t in: German or English				
Method	l of ass		ge — if other than German,	examination offered — if no	t every semester, information on whether	
b) oral of c) oral of d) project e) presect If a writt stead ta of assect nation of Langua Assessor Allocati	examin examin ect repo entatio ten exa ake the ssment date at ge of a ment o ion of p	form of an oral examina t is changed, the lecturer the latest. ssessment: German and, ffered: In the semester in	ach (approx. 30 minu of 2, approx. 30 minu o) or es). method of assessmu tion of one candidate must inform student /or English	tes per candidate) or ent, this may be char e each or an oral exar is about this by four y	nged and assessment may in- mination in groups. If the method weeks prior to the original exami-	
Worklo	ad					
180 h						
Master's wi	th 1 major	Mathematical Physics (2020)		generated 19-Apr-2025 • exa		

Teaching cycle

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

Module appears in

Master's degree (1 major) Mathematics (2016)

Master's degree (1 major) Physics (2016)

Master's degree (1 major) Mathematical Physics (2016)

Master's degree (1 major) Computational Mathematics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)



Module Group Current Topics

(ECTS credits)

Module	title				Abbreviation
Current	Topics	s of Mathematical Physic	5		11-EXMP5-161-m01
Module	coord	inator		Module offered by	
chairpe	rson of	f examination committee		Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Approval from exam	ination committee re	equired.
Conten	ts				
Current study a	•	in Mathematical Physics	. Credited academic	achievements, e.g. i	n case of change of university or
Intende	ed learr	ning outcomes			
sics of underst	the Ma tand th	ster's programme. They h	ave knowledge of a c	urrent subdiscipline	of a module of Mathematical Phy- e of Mathematical Physics and classify the subject-specific con-
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) +	R (2)				
		e essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
b) oral c c) oral c d) proje e) prese If a writ stead ta of asse nation	examin examin ect repo entatio ten exa ake the ssment date at	form of an oral examina	ach (approx. 30 minu of 2, approx. 30 minut) or es) method of assessme tion of one candidate must inform student	tes per candidate) of ent, this may be char each or an oral exam	r nged and assessment may in- mination in groups. If the method weeks prior to the original exami-
Allocat					
Additio	nal info	ormation			
Worklo	ad				
150 h					
Teachir	ng cyclo	e			
Referre	d to in	LPO I (examination regulations	for teaching-degree progra	mmes)	
Module	appea	in			
	-	ee (1 major) Mathematica			
	-	ee (1 major) Mathematica	· · ·		
waster	s aegre	ee (1 major) Mathematica	ii Priysics (2022)		

Module	title				Abbreviation
Current	Topics	s of Mathematical Physic	5		11-EXMP6-161-m01
Module	coord	inator		Module offered by	
chairpe	rson of	f examination committee		Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Approval from exam	ination committee re	equired.
Conten	ts				
Current study a	•	in Mathematical Physics	. Credited academic a	achievements, e.g. i	n case of change of university or
Intende	ed learn	ning outcomes			
sics of t underst	the Ma tand th	ster's programme. They h	ave knowledge of a d	urrent subdiscipline	of a module of Mathematical Phy- e of Mathematical Physics and classify the subject-specific con-
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (3) +	R (1)				
		e ssment (type, scope, langua) le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
 b) oral a c) oral a d) proja e) presa lf a writ stead ta of asse 	examin examin ect repo entatio ten exa ake the ssment	form of an oral examinat t is changed, the lecturer	ach (approx. 30 minu of 2, approx. 30 minut) or es) method of assessme tion of one candidate	es per candidate) of ent, this may be char each or an oral exa	r nged and assessment may in- mination in groups. If the method weeks prior to the original exami-
		the latest. ssessment: German and/	or English		
Allocat					
Additio	nal info	ormation			
Worklo	ad				
180 h					
Teachir	ng cycl	e			
Referre	d to in	LPO I (examination regulations	for teaching-degree progra	mmes)	
Module	appea	irs in			
	-	ee (1 major) Mathematica			
	-	ee (1 major) Mathematica			
master	s degre	ee (1 major) Mathematica	1 Physics (2022)		

Module	title				Abbreviation	
Current	Topics	s of Mathematical Physic	S		11-EXMP7-161-m01	
Module	coord	inator		Module offered by		
chairpe	rson of	f examination committee		Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
7	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Approval from exam	ination committee re	equired.	
Conten	ts					
Current study a	•	in Mathematical Physics	. Credited academic	achievements, e.g. i	n case of change of university or	
Intende	ed learr	ning outcomes				
sics of t underst	the Ma tand th	ster's programme. They h	ave knowledge of a d	urrent subdiscipline	of a module of Mathematical Phy- e of Mathematical Physics and classify the subject-specific con-	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (3) + I	R (1)					
		s essment (type, scope, langua; le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
b) oral (c) oral (d) proje e) prese If a writ	examin examin ect repo entatio ten exa		ach (approx. 30 minu of 2, approx. 30 minut) or es) method of assessme	tes per candidate) or ent, this may be char	r nged and assessment may in- mination in groups. If the method	
of asse nation	ssment date at		must inform student		weeks prior to the original exami-	
Allocat	-		or English			
Additio	nal info	ormation				
Worklo	ad					
210 h						
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulations	for teaching-degree progra	mmes)		
		-	•			
Module	appea	irs in				
Master'	s degre	ee (1 major) Mathematica	l Physics (2016)			
	-	ee (1 major) Mathematica	· · ·			
Master'	s degre	ee (1 major) Mathematica	ll Physics (2022)			

Module	e title				Abbreviation
Current	Topics	s of Mathematical Physic	S		11-EXMP8-161-m01
Module	coord	inator		Module offered by	
chairpe	erson of	f examination committee		Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Approval from exam	ination committee re	equired.
Conten	ts				
Current or stud	•	-	. Accredited academi	c achievements, e.g	, in case of change of university
Intende	ed learn	ning outcomes			
sics of underst	the Ma tand th	ster's programme. They h	ave knowledge of a c	urrent subdiscipline	of a module of Mathematical Phy- e of Mathematical Physics and classify the subject-specific con-
		umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) +	R (2)				
		e ssment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
b) oral c c) oral c d) proje e) prese If a writ stead ta of asse	examin examin ect repo entatio ten exa ake the ssment	form of an oral examinat	ach (approx. 30 minu of 2, approx. 30 minut) or es) method of assessme tion of one candidate	es per candidate) or ent, this may be char each or an oral exar	r nged and assessment may in- mination in groups. If the method weeks prior to the original exami-
Langua	ge of a	ssessment: German and,	or English		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
240 h					
Teachir	ng cycl	9			
Referre	d to in	LPOI (examination regulations	for teaching-degree progra	mmes)	
Module					
	-	ee (1 major) Mathematica			
	-	ee (1 major) Mathematica ee (1 major) Mathematica	· · ·		
master	s uegi		11 FILYSILS (2022)		



Subfield Research in Groups

(10 ECTS credits)

Module	Module title Abbreviation					
Resear	ch in G	roups - Algebra			10-M=GALG-161-m)1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathe	matics)	Institute of Mathem	natics	
ECTS	Meth	od of grading	Only after succ. cor	mpl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites	5		
1 seme	ster	graduate				
Conten	Its					
puter a Recom	lgebra mende nowlee	ern topics in algebra (e , algebras, division ring d previous knowledge: dge of algebra is assum bra".	s, quadratic forms).	-	-	
Intend	ed lear	ning outcomes				
		ains insight into conter eld and can apply them			She masters advance	ed techni-
Course	S (type, 1	number of weekly contact hour	s, language — if other than Ge	erman)		
V (2) +						
		t in: German and/or En				
		sessment (type, scope, lang	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
		o minutes)				
		issessment: German or	English			
-	-	ffered: In the semester	-	offered and in the su	ubsequent semester	,
Allocat	ion of	places				
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	е				
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progr	ammes)		
Module	e appea	ars in				
	-	-				
Master Supple Master Master Supple Master	Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022)					
Master's w	ith 1 majo	r Mathematical Physics (2020)		• generated 19-Apr-2025 • exa r (120 ECTS) Mathematische P		page 228 / 281

Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	Module title Abbreviation					
Resear	ch in G	roups - Discrete Mathem	atics		10-M=GDIM-161-mo)1
Module	coord	inator		Module offered by	_	
Dean of	fStudi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
10	nume	rical grade				
Duratio		Module level	Other prerequisites			
1 seme		graduate				
Conten		Sidduite	<u> </u>			
		ern topics in discrete ma	inematics.			
		ning outcomes				
		ains insight into contemp is in this field and can ap			nematics. He/She ma	asters advan-
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Gei	man)		
V (2) + 3	S (2)					
Module	e taugh	t in: German and/or Engl	ish			
Method	l of ass	Sessment (type, scope, langua	ge — if other than German,	examination offered — if no	t every semester, informat	ion on whether
		le for bonus)				
talk (6c	to 120	o minutes)				
		ssessment: German or Er				
Assess	ment o	ffered: In the semester in	which the course is	offered and in the su	ibsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachir		•				
Teaciiii	ig tyti	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module	e appea	ars in				
Master'	s degr	ee (1 major) Mathematics	5 (2016)			
		ee (1 major) Mathematica				
Master'	s teacl	ning degree Gymnasium I	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)
Supple	mentai	y course MINT Teacher E	ducation PLUS, Elite	Network Bavaria (EN	B) (2016)	
	-	ee (1 major) Mathematics	-			
		ning degree Gymnasium I				020)
		y course MINT Teacher E		Network Bavaria (EN	B) (2020)	
	-	ee (1 major) Mathematica	-	``		
		ee (1 major) Computation		2)		
	-	ee (1 major) Mathematics				
	-	ee (1 major) Mathematica	-			
		gram Mathematics (2023)				
		ee (1 major) Computation		4)		
waster'	s aegr	ee (1 major) Mathematics	(2024)			I
Master's wi	th 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische Pl	-	page 230 / 281



Module	e title				Abbreviation		
Resear	ch in G	roups - Dynamical Syste	ms and Control Theo	ry	10-M=GDSC-161-m	01	
Module	e coord	inator		Module offered by			
Dean o	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	natics		
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)			
10	1	rical grade		· · · · · · · · · · · · · · · · · · ·			
Duratio	·	Module level	vel Other prerequisites				
1 seme		graduate					
Conten	ts						
Recom	mende	ern topics in dynamical s d previous knowledge:					
		the contents of the modu ning outcomes	ule "Mathematical Co	ntrol Theory" or "Col	ntrol Theory" is requ	irea.	
			orany rocoarch probl	ome in dunamical au	stoms and control th	noon, Hol	
		ains insight into contemp dvanced techniques in t				еоту. пе/	
		umber of weekly contact hours,		· · · ·			
V (2) +		amper of weekly contact hours,					
		t in: German and/or Engl	ish				
		eessment (type, scope, langua le for bonus)	age — if other than German, o	examination offered — if no	ot every semester, informat	ion on whether	
		o minutes)					
-		ssessment: German or E	nglish				
		ffered: In the semester ir		offered and in the su	ubsequent semester		
Allocat	ion of p	olaces					
Additio	onal inf	ormation					
World o							
Worklo							
300 h							
Teachi	ng cycl	e					
Referre	ed to in	LPOI (examination regulation	s for teaching-degree progra	mmes)			
Module	e appea	urs in					
		ee (1 major) Mathematics	5 (2016)				
	-	ee (1 major) Economathe					
	-	ee (1 major) Mathematica					
	-	ning degree Gymnasium	•	ion PLUS. Elite Netw	ork Bavaria (FNB) (2	016)	
		y course MINT Teacher E					
		ee (1 major) Mathematics			/ //		
	-	ning degree Gymnasium	•	ion PLUS, Elite Netw	ork Bavaria (ENB) (2	020)	
		y course MINT Teacher E					
		ee (1 major) Mathematica					
	-	ee (1 major) Economathe	•				
				2)			
		Master's degree (1 major) Computational Mathematics (2022)					
Aactor's	+ + + + + + + + + + + + + + + + + + + +	Mathematical Physics (2020)	INALL VALUE IN THE CONTRACT OF	generated 19-Apr-2025 • exa	am rog da	page 232 / 281	



Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023)

Module	Module title Abbreviation					
Resear	ch in G	roups - Complex Analy	sis		10-M=GCOA-161-m	01
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathe	matics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	•	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
geome Recom Depend	tric con mende ding on	nplex analysis, value d d previous knowledge: the current focus of th	·	om different areas of		
Intend	ed lear	ning outcomes				
			nporary research probl y them to complex prol		ysis. He/She maste	rs advanced
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V (2) +	S (2)					
Module	e taugh	t in: German and/or En	glish			
			guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
		le for bonus)				
		o minutes) Issessment: German or	English			
			r in which the course is	offered and in the su	ıbsequent semester	
Allocat	ion of _l	places				
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)		
Module	e appea	ars in				
	-	ee (1 major) Mathemat				
	-	ee (1 major) Mathemat	-			
			m MINT Teacher Educat Education PLUS, Elite			U16J
		ee (1 major) Mathemati			6, (2010)	
	-		n MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (2	020)
		•	Education PLUS, Elite	Network Bavaria (EN	B) (2020)	
	-	ee (1 major) Mathemati	•			
Master	's degr	ee (1 major) Computati	onal Mathematics (202	2)		
Master's w	ith 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 234 / 281

Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	Nodule title Abbreviation						
Resear	ch in G	roups - Geometry and To	opology		10-M=GGMT-161-m	01	
Module	coord	inator		Module offered by	_		
Dean of	fStudi	es Mathematik (Mathem	atics)	Institute of Mathem	atics		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
10	nume	rical grade					
Duratio		Module level	Other prerequisites				
1 seme	ster	graduate					
Conten		Sidduite					
		ern topics in geometry a	na topology.				
		ning outcomes					
		ains insight into contem ques in this field and ca			l topology. He/She n	nasters ad-	
Course	S (type, r	number of weekly contact hours,	language — if other than Ge	rman)			
V (2) + 3	S (2)						
Module	e taugh	t in: German and/or Eng	lish				
Method	l of ass	sessment (type, scope, langu	age — if other than German,	examination offered — if no	t every semester, informati	on on whether	
		le for bonus)					
talk (6c	to 120	o minutes)					
		ssessment: German or E					
Assess	ment o	ffered: In the semester i	n which the course is	offered and in the su	ıbsequent semester		
Allocat	ion of p	olaces	_				
Additio	nal inf	ormation					
Worklo	ad						
300 h							
Teachir		<u> </u>					
Teaciiii	ig tyti	e	-				
Referre	d to in	LPO I (examination regulation	ns for teaching-degree progra	immes)			
Module	e appea	ars in					
Master'	s degr	ee (1 major) Mathematic	s (2016)				
Master'	s degr	ee (1 major) Mathematic	al Physics (2016)				
Master'	s teacl	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)	
		y course MINT Teacher I		Network Bavaria (EN	B) (2016)		
	-	ee (1 major) Mathematic					
		ning degree Gymnasium				020)	
		y course MINT Teacher I		Network Bavaria (EN	B) (2020)		
	-	ee (1 major) Mathematic	•	`			
		ee (1 major) Computatio		2)			
	-	ee (1 major) Mathematic					
	-	ee (1 major) Mathematic	•				
		gram Mathematics (202					
	-	ee (1 major) Computatio		:4)			
master	s degr	ee (1 major) Mathematic	5 (2024)				
Master's wi	th 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 236 / 281	



Module	e title				Abbreviation		
Resear	ch in G	roups - Mathematics in (Context		10-M=GMCX-161-m	01	
Module	e coord	inator		Module offered by	l		
		es Mathematik (Mathema	atics)	Institute of Mathem	atics		
ECTS	r –	od of grading	Only after succ. com				
10 Duratio		rical grade Module level	Other prerequisites				
1 seme		graduate	_other prerequisites				
Conten		Sladdale	<u> </u>				
Reflect ven by the cor	ion on i a histo inection	mathematics in a cultura rical period, a geographi n of mathematics with lit	c region or a particula	ar field of mathemati	cs. Other possibiliti		
		ning outcomes					
The stu	dent re	alises the cultural dimer	nsion of mathematics	and its relation to o	ther cultural fields.		
Course	S (type, n	umber of weekly contact hours,	anguage — if other than Ger	rman)			
V (2) + Module		t in: German and/or Engl	ish				
		essment (type, scope, langua	ge — if other than German, e	examination offered — if no	t every semester, informat	ion on whether	
		le for bonus)	-				
Langua	ige of a) minutes) ssessment: German or E ffered: In the semester ir		offered and in the si	ihsequent semester		
Allocat					ibsequent semester		
Allocal		Jaces					
 Additio	nal inf	ormation					
Worklo	ad						
300 h							
-	ng cycl	e					
	<u></u>	•					
Roforro	d to in	LPO I (examination regulation	s for toaching dogroo progra	mmoc)			
Keleffe							
Module	e appea	irs in					
Master	's degr	ee (1 major) Mathematics	5 (2016)				
Master	's degr	ee (1 major) Mathematica	al Physics (2016)				
		ning degree Gymnasium				016)	
		y course MINT Teacher E		Network Bavaria (EN	B) (2016)		
		ee (1 major) Mathematics				`	
		ning degree Gymnasium				020)	
		y course MINT Teacher E		vetwork Bavaria (EN	Б) (2020)		
	-	ee (1 major) Mathematica ee (1 major) Computatior		2)			
	-	ee (1 major) Mathematics		<i>-</i> ,			
	-	ee (1 major) Mathematica					
	-	gram Mathematics (2023	•				
		ee (1 major) Computation		4)			
Master's w	ith 1 majoı	Mathematical Physics (2020)		generated 19-Apr-2025 • exa	-	page 238 / 281	
			ta record Master	(120 ECTS) Mathematische P	hysik - 2020		



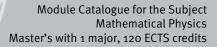
Master's degree (1 major) Mathematics (2024)

Module title					Abbreviation	
Research in Groups - Mathematics in the Sciences					10-M=GMSC-161-m	01
Module	coord	inator		Module offered by		
Dean of Studies Mathematik (Mathema			atics)	Institute of Mathematics		
ECTS Method of grading Only after succ. compl.			npl. of module(s)			
10		rical grade				
Duratio		Module level	Other prerequisites			
1 semes		graduate				
		giauuale				
Conten		· · · · · · · · · · · · · · · · · · ·				
A mode	ern top	ic in mathematics in the	sciences.			
Recom	nende	d previous knowledge:				
		lge from the modules "C	ordinary Differential Ec	quations" and "Introd	duction to Partial Dif	ferential
Equatio	ons" is	recommended, as well a	as basic knowledge of	functional analysis.		
Intende	ed lear	ning outcomes				
The stu	dent g	ains insight into contem	porary research probl	ems in mathematics	in the sciences. He/	She masters
advanc	ed tecl	nniques in this field and	can apply them to co	mplex problems.		
Courses	S (type, r	number of weekly contact hours,	language — if other than Ge	rman)		
V (2) + 3	S (2)					
Module	taugh	t in: German and/or Eng	lish			
		sessment (type, scope, langu ile for bonus)	age — if other than German,	examination offered — if no	t every semester, informat	ion on whether
talk (6c) to 120	o minutes)				
		ssessment: German or E	Inglish			
Assessment offered: In the semester in which the course is offered and in the subsequent semester						
Allocation of places						
Additio	nal inf	ormation				
Worklo	ad		_			
300 h						
Teachir		0	_			
Teacini	ig cyci	C				
Referre	a to in	LPO I (examination regulation	ns for teaching-degree progra	immes)		
Module						
	0	ee (1 major) Mathematic	. ,			
	-	ee (1 major) Mathematic	•			
	-	ee (1 major) Computatio				
		hing degree Gymnasium				016)
		ry course MINT Teacher I			B) (2016)	
	-	ee (1 major) Computatio ee (1 major) Mathematic		9)		
	-	hing degree Gymnasium	-	ion PLUS Flite Notw	ork Bayaria (FNB) (a	020)
		ry course MINT Teacher I				020)
		ee (1 major) Mathematic		LENI Davalla (ENI	U) (2020)	
	2 4051	ee (1 major) mathematic				
Master's wi	th 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 240 / 281

Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	e title				Abbreviation	
Research in Groups - Measure and Integral10-M=GMAI-161-m01					01	
Module	e coord	inator		Module offered by	ered by	
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	1	rical grade		• • • • •		
Duration Module level Other prerequisites						
1 semester graduate -						
Conten		gladdale	1			
Aspect functio	s of me ns and	asure and integration th Lebesgue integrals, sele n rule), Lp spaces and al	ected applications, e.	g. product measures	s (with Fubini's theo	
Intend	ed lear	ning outcomes				
sters a	dvance	ains insight into contem d techniques in this field	and can apply them	to complex problem		He/She ma-
	-	number of weekly contact hours,	language — if other than Ge	rman)		
V (2) +		tin. Cormon and lar Fra-	lich			
		t in: German and/or Eng				
		sessment (type, scope, langua le for bonus)	age — If other than German,	examination offered — if no	ot every semester, informat	ion on whether
		o minutes)	-			
		ssessment: German or E	nglish			
		ffered: In the semester i		offered and in the s	ubsequent semester	
Allocat	ion of _l	olaces				
Additio	onal inf	ormation				
Worklo	ad					
300 h	au					
Teachi						
Teacini	ing cyci	e				
Referre	ed to in	LPO I (examination regulation	is for teaching-degree progra	ammes)		
Module						
	-	ee (1 major) Mathematic				
	-	ee (1 major) Economathe				
	-	ee (1 major) Mathematic			orly Douoria (END) (-	o.()
		ning degree Gymnasium Y course MINT Teacher E				U16 <i>)</i>
		ee (1 major) Mathematic		NELWOIR DAVAIIA (EN	(2010)	
	-	ning degree Gymnasium	-	ion PLUS, Elite Netw	ork Bavaria (ENB) (2	020)
		y course MINT Teacher E				- /
		ee (1 major) Mathematic				
	-	ee (1 major) Economathe				
	-	ee (1 major) Computation		22)		
Master	's degr	ee (1 major) Mathematic	s (2022)			
Master's w	ith 1 majo	r Mathematical Physics (2020)	-	• generated 19-Apr-2025 • ex	-	page 242 / 281
			ta record Master	(120 ECTS) Mathematische F	TIYSIK - 2020	



Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Economathematics (2025)

	e title				Abbreviation	
Research in Groups - Numerical Mathematics and Applied Analysis10-M=GNMA-161-m01						01
Module coordinator Module offered by					<u> </u>	
Dean of Studies Mathematik (Mathematics)			Institute of Mathem	natics		
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
10	1	rical grade				
Duration Module level Other prerequisites						
1 seme		graduate	<u> </u>			
Conten						
Recom Depend	mende ding on	s in numerical mathema d previous knowledge: the content, basic and a equired. In case of doub	advanced knowledge	from different areas	of analysis and/or n	umerical ma
		ning outcomes	;			
The stu	ident ga	ains insight into a content rs advanced techniques				ied analysis.
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	rman)		
V (2) + Module		t in: German and/or Eng	lish			
		e essment (type, scope, languale le for bonus)	age — if other than German, o	examination offered — if no	t every semester, informati	ion on whether
		minutes)				
Langua Assess	ige of a ment o	ssessment: German or E ffered: In the semester i	nglish n which the course is	offered and in the su	ıbsequent semester	
Allocat	ion of p	olaces				
 Additio	nal inf	ormation				
 Additio	onal info	ormation				
		ormation				
 Worklo		ormation				
 Worklo 300 h	ad					
 Worklo	ad					
 Worklo 300 h Teachin	ad ng cycl	9				
 Worklo 300 h Teachin	ad ng cycl		ns for teaching-degree progra	mmes)		
 Worklo 300 h Teachin	ad ng cycl	9	is for teaching-degree progra	mmes)		
 Worklo 300 h Teachii	ad ng cycl ed to in	e LPO I (examination regulation	is for teaching-degree progra	mmes)		
 Worklo 300 h Teachin Referre Module Master Master	ad ng cyclo ed to in e appea 's degro	e LPO I (examination regulation	s (2016) ematics (2016)	mmes)		
 Worklo 300 h Teachin Referre Module Master Master Master	ad ng cyclo ed to in 's degro 's degro 's degro	e LPO I (examination regulation I rs in ee (1 major) Mathematic ee (1 major) Economathe	s (2016) ematics (2016) al Physics (2016)			
 Worklo 300 h Teachin Referre Module Master Master Master Master Master Master	ad ng cyclo ed to in 's degro 's degro 's degro 's degro 's teach	e LPO I (examination regulation ars in ee (1 major) Mathematic ee (1 major) Economathe ee (1 major) Mathematic ee (1 major) Computation ning degree Gymnasium	s (2016) ematics (2016) al Physics (2016) nal Mathematics (201 MINT Teacher Educat	6) ion PLUS, Elite Netw		016)
 Worklo 300 h Teachin Referre Master Master Master Master Master Supple	ad ng cycle ed to in 's degre 's degre 's degre 's degre 's degre 's teach mentar	e LPO I (examination regulation rs in ee (1 major) Mathematic ee (1 major) Economathe ee (1 major) Mathematic ee (1 major) Mathematic ee (1 major) Computation ning degree Gymnasium y course MINT Teacher E	s (2016) ematics (2016) al Physics (2016) nal Mathematics (201 MINT Teacher Educat ducation PLUS, Elite I	6) ion PLUS, Elite Netw Network Bavaria (EN		016)
 Worklo 300 h Teachin Referre Master Master Master Master Supple Master	ad ng cyclo ed to in 's degro 's degro 's degro 's teach mentar 's degro	e LPO I (examination regulation ars in ee (1 major) Mathematic ee (1 major) Economathe ee (1 major) Mathematic ee (1 major) Computation ning degree Gymnasium y course MINT Teacher E ee (1 major) Computation	s (2016) ematics (2016) al Physics (2016) nal Mathematics (201 MINT Teacher Educat iducation PLUS, Elite I nal Mathematics (201	6) ion PLUS, Elite Netw Network Bavaria (EN		016)
 Worklo 300 h Teachin Teachin Teachin Teachin Teachin Medule Master	ad ng cyclo ed to in 's degro 's degro 's degro 's teach mentar 's degro 's degro 's degro 's teach	e LPO I (examination regulation rs in ee (1 major) Mathematic ee (1 major) Economathe ee (1 major) Mathematic ee (1 major) Mathematic ee (1 major) Computation ning degree Gymnasium y course MINT Teacher E	s (2016) ematics (2016) al Physics (2016) nal Mathematics (201 MINT Teacher Educat ducation PLUS, Elite I nal Mathematics (201 s (2019) MINT Teacher Educat	6) ion PLUS, Elite Netw Network Bavaria (EN 9) ion PLUS, Elite Netw	B) (2016) ork Bavaria (ENB) (20	

Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025)

Module	e title				Abbreviation		
Research in Groups - Robotics, Optimization and Control Theory10-M=GROC-161-m01					01		
Module coordinator				Module offered by			
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics		
ECTS	Metho	od of grading	Only after succ. compl. of module(s)				
10	1	rical grade					
Duration Module level Other prerequisites							
1 seme		graduate					
Contents							
		ern topics in robotics, or	timisation and contro	al theory			
Jelecie	umou	em topics in tobotics, of		n meory.			
Recom	mende	d previous knowledge:					
Knowle	edge of	the contents of the mod	ule "Mathematical Co	ntrol Theory" or "Coi	ntrol Theory" is requi	ired.	
Intend	ed lear	ning outcomes					
The stu	ident g	ains insight into contem	porary research proble	ems in robotics, opti	mization and contro	l theory. He/	
		dvanced techniques in t				, ,	
Course	S (type, r	umber of weekly contact hours,	language — if other than Ger	man)			
V (2) +	S (2)						
• •	• •	t in: German and/or Eng	lish				
Metho	d of ass	essment (type, scope, langua	age — if other than German, e	examination offered — if no	ot every semester, informat	ion on whether	
module is	s creditab	le for bonus)					
		o minutes)					
		ssessment: German or E					
		ffered: In the semester in	n which the course is	offered and in the si	ibsequent semester		
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
300 h							
Teachi	ng cvcl	6	_				
	3 - 9 - 0	-					
Deferre	d to in		o fortoophing day	mmoc)			
Neielle		LPOI (examination regulation	is for teaching-degree progra	ninnes)			
		•					
Module							
	-	ee (1 major) Mathematic					
	-	ee (1 major) Economathe					
	-	ee (1 major) Mathematic	•	()			
	-	ee (1 major) Computatioı ning degree Gymnasium			ork Bayaria (FNR) (a	016)	
		y course MINT Teacher E				010)	
		ee (1 major) Computation			_, (2010)		
	-	ee (1 major) Mathematic		//			
	-		-	ion PLUS, Elite Netw	ork Bavaria (ENB) (2	020)	
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
	mentu	y course mintri reacher L	Luucation FLOS, Eine i	VELWOIK Davalla (LIV	B) (2020)		
Supple		ee (1 major) Mathematic			B) (2020)		
Supple Master	's degr	-	al Physics (2020)	generated 19-Apr-2025 • exa		page 246 / 281	

Master's degree (1 major) Economathematics (2021)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

Master's degree (1 major) Economathematics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's degree (1 major) Economathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Economathematics (2025)

Module title Abbreviation							
Research in Groups - Time Series Analysis 10-M=GTSA-161-m01)1		
Module	e coord	inator		Module offered by			
Dean of Studies Mathematik (Mathematics) Institute of Mathematics			atics				
ECTS Method of grading			Only after succ. compl. of module(s)				
10							
Duratio							
		graduate					
Conten							
Selecte	d mod	ern topics in time series	analysis.				
Recom	nende	d previous knowledge:					
		lge of stochastics is requ	uired, such as that ac	quired in the "Stocha	astics 1" module. Kn	owledge of	
the con	tents c	of the module "Stochasti	cs 2" is also recomme	ended.		-	
Intende	ed lear	ning outcomes					
The stu	dent g	ains insight into contem	orary research probl	ems in time series ar	nalysis. He/She mas	ters advan-	
		es in this field and can ap			, ,		
Course	S (type, r	number of weekly contact hours,	language — if other than Gei	man)			
V (2) +	S (2)						
		t in: German and/or Engl	lish				
Method	l of ass	Sessment (type, scope, langua	age — if other than German,	examination offered — if no	t every semester, informati	ion on whether	
		le for bonus)					
talk (60) to 120	o minutes)					
Langua	ge of a	ssessment: German or E					
Assessment offered: In the semester in which the course is offered and in the subsequent semester							
Allocation of places							
Additional information							
		-					
Worklo	ad						
	au						
300 h			-				
Teachi	ig cycl	е					
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)			
Module	e appea	ars in					
Master	's degr	ee (1 major) Mathematics	5 (2016)				
Master	's degr	ee (1 major) Economathe	matics (2016)				
	-	ee (1 major) Mathematica	•				
		ning degree Gymnasium				016)	
		y course MINT Teacher E		Network Bavaria (EN	B) (2016)		
	-	ee (1 major) Mathematics	-				
		ning degree Gymnasium				020)	
		y course MINT Teacher E ee (1 major) Mathematica		vetwork bavafia (EN	DJ (2020)		
		ee (1 major) Mathematica ee (1 major) Economathe					
master	Jucgi					I	
Master's wi	th 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 248 / 281	

Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Economathematics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Economathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Economathematics (2025)

Module title					Abbreviation		
Research in Groups - Statistics10-M=GSTA-161-m01					01		
Module	e coord	inator		Module offered by			
Dean of Studies Mathematik (Mathema			matics)	s) Institute of Mathematics			
ECTS Method of grading			Only after succ. cor	npl. of module(s)			
10	nume	rical grade					
Duratio	on	Module level	Other prerequisites	5			
1 seme	ster	graduate					
Conten	Contents						
Selecte	ed mod	ern topics in statistics.					
Basic k the con	nowlea itents a	d previous knowledge: dge of stochastics is re of the module "Stochas ge may also be helpful	tics 2" is also recomme	ended. Depending or	n the content of the o		
Intende	ed lear	ning outcomes					
		ains insight into conter eld and can apply them			/She masters advan	ced techni-	
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)			
V (2) +							
		t in: German and/or En					
		sessment (type, scope, lang	guage — if other than German,	examination offered — if no	t every semester, informat	on on whether	
		o minutes)					
		ssessment: German or	English				
		ffered: In the semester		offered and in the su	ubsequent semester		
Allocat	ion of _l	olaces					
Additio	nal inf	ormation					
Worklo	ad						
300 h							
Teachir	ng cycl	e					
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)			
Module	e appea	ars in					
	-	ee (1 major) Mathemat					
	-	ee (1 major) Economatl					
	-	ee (1 major) Mathemat hing degree Gymnasiur	•	ion PLUS Elite Netwo	ork Bayaria (FNB) (2)	o16)	
		ry course MINT Teacher					
		ee (1 major) Mathemat					
		hing degree Gymnasiur				020)	
		ry course MINT Teacher		Network Bavaria (EN	B) (2020)		
master	s degr	ee (1 major) Mathemat	ical Physics (2020)			I	
Master's wi	ith 1 majo	r Mathematical Physics (2020)	-	• generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 250 / 281	

Master's degree (1 major) Economathematics (2021)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Mathematics (2022)

Master's degree (1 major) Mathematical Physics (2022)

Master's degree (1 major) Economathematics (2022)

exchange program Mathematics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's degree (1 major) Economathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Mathematical Data Science (2025)

Master's degree (1 major) Economathematics (2025)

Module title					Abbreviation	
Research in Groups - Number Theory10-M=GNTH-					10-M=GNTH-161-m	01
Module	e coord	inator		Module offered by		
Dean of Studies Mathematik (Mathema			matics)	Institute of Mathematics		
ECTS Method of grading			Only after succ. con	npl. of module(s)		
10 numerical grade						
Duratio		Module level	Other prerequisites			
1 seme		graduate				
Contents						
		ern topics in number th		imber theony modul	ar forms dionhantir	analysis)
Selecte	eu mou	eni topics în number ti	ieoly (e. g. algeblaic iit	iniber theory, modul	ai ionnis, uiophantin	le allatysis).
Recom	mende	d previous knowledge:				
		lge of algebra and num	ber theory is assumed	, such as can be acq	uired in the modules	s "Introducti-
on to A	lgebra	', "Introduction to Num	ber Theory" and "Appli	ed Algebra".		
Intende	ed lear	ning outcomes				
The stu	ident g	ains insight into conter	nporary research probl	ems in numer theory	. He/She masters ad	lvanced tech-
niques	in this	field and can apply the	em to complex problem	S.		
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V (2) +	S (2)					
Module	e taugh	t in: German and/or En	glish			
Metho	d of ass	sessment (type, scope, lang	guage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
		le for bonus)				
talk (60	o to 120	o minutes)				
		ssessment: German or				
Assessment offered: In the semester in which the course is offered and in the subsequent semester						
Allocation of places						
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi		0				
Teacini	ing cyci	e				
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)		
Module	e appea	ars in				
Master	's degr	ee (1 major) Mathemat	ics (2016)			
	-	ee (1 major) Mathemat	-			
		hing degree Gymnasiur				016)
		ry course MINT Teacher		Network Bavaria (EN	B) (2016)	
	-	ee (1 major) Mathemat				,
		hing degree Gymnasiur				020)
		ry course MINT Teacher		Network Bavaria (EN	В) (2020)	
		ee (1 major) Mathemati				
	-	ee (1 major) Computati		2)		
master	s degr	ee (1 major) Mathemat	15 (2022)			l
Master's w	ith 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 252 / 281

Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	e title				Abbreviation	
Resear	ch in G	roups - Control Theory of	Quantum Mechanica	al Systems	10-M=GCQS-161-m01	
Module	e coord	inator		Module offere	d by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Ma	thematics	
ECTS Method of grading Only after succ. compl. of module(s)					5)	
10	10 numerical grade					
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
	Contents					
		ern topics in control theo	ny of quantum mecha	nical systems		
		ning outcomes		ameat systems.		
		-		• • • •		
					heory of quantum mechanical sy- em to complex problems.	
		umber of weekly contact hours, l				
		umber of weekly contact hours, l	anguage — II other than Ger	iiidii)		
V (2) + Module		t in: German and/or Engl	ish			
				warmination offered	— if not every semester, information on whether	
		le for bonus)	ge — II other than German, i		- If not every semester, mornation on whether	
		minutes)				
Langua	ige of a	ssessment: German or Ei				
Assess	ment o	ffered: In the semester ir	which the course is	offered and in t	he subsequent semester	
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	A				
reacin	ing cycl	•				
Dofor	d to in		Contraction 1			
Referre		LPOI (examination regulation	s for teaching-degree progra	mmes)		
		•				
Module						
	-	ee (1 major) Mathematics				
		ee (1 major) Mathematica		ion DILLS Elito	Notwork Poweria (ENP) (2016)	
		y course MINT Teacher E			Network Bavaria (ENB) (2016) a (ENB) (2016)	
		ee (1 major) Mathematics				
	-		-	ion PLUS, Elite I	Network Bavaria (ENB) (2020)	
		y course MINT Teacher E				
	-	ee (1 major) Mathematica	-			
	-	ee (1 major) Computation		2)		
	-	ee (1 major) Mathematics				
	-	ee (1 major) Mathematica	-			
exchan	ige brog	gram Mathematics (2023)			

Module	Module title						
Resear	ch in G	roups - Differential Ge	ometry		10-M=GDGE-161-m	01	
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mathe	matics)	Institute of Mathem	natics		
ECTS	Meth	od of grading	Only after succ. cor	Dnly after succ. compl. of module(s)			
10	nume	rical grade					
Duration Module level Other prerequisites							
1 seme	1 semester graduate						
Conten	ts	<u>.</u>	·				
Selecte	Selected modern topics in differential geometry.						
Advanc Geome	ced kno try". Kr	d previous knowledge: owledge of differential g nowledge of the conten pannian and Riemannia	ts of the modules "App	olied Differential Geo	metry", "Geometric I		
Intende	ed lear	ning outcomes					
		ains insight into conter es in this field and can			eometry. He/She ma	asters advan-	
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)			
V (2) +	S (2)						
Module	e taugh	t in: German and/or En	glish				
		Sessment (type, scope, lang ble for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether	
		o minutes)					
Langua	ige of a	ssessment: German or					
		ffered: In the semester	in which the course is	offered and in the su	ubsequent semester		
Allocat	ion of _l	places					
Additio	onal inf	ormation					
Worklo	ad						
300 h							
Teachi	ng cycl	e					
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)			
		•					
Module							
	-	ee (1 major) Mathemati ee (1 major) Mathemati					
	-		-	tion PLUS. Elite Netwo	ork Bavaria (ENB) (2	016)	
	Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
	-	ee (1 major) Mathemati	-				
		hing degree Gymnasiur				020)	
	Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)						
	-	ee (1 major) Mathemati ee (1 major) Computati	•	22)			
Master's wi	ith 1 majo	r Mathematical Physics (2020)	-	• generated 19-Apr-2025 • exa r (120 ECTS) Mathematische P	-	page 255 / 281	

Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	Module title Abbreviation									
Resear	ch in G	roups - Deformation Qua	antization		10-M=GDFQ-161-m	01				
Module	coord	inator		Module offered by						
		es Mathematik (Mathema	atics)	Institute of Mathem	atics					
ECTS		· · · · ·								
10 numerical grade Duration Module level Other prerequisites										
1 seme		graduate								
Contents										
Selecte	ed mod	ern topics in deformatior	n quantization.							
Recom	mende	d previous knowledge:								
Knowle	dge of	the contents of the mod	ules "Differential Geo	metry" and "Geomet	ric Mechanics" is rec	commended.				
Intende	ed learn	ning outcomes								
		ains insight into contemp nniques in this field and			Quantization. He/Sh	e masters				
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	man)						
V (2) + 2										
		t in: German and/or Engl								
		s essment (type, scope, langua le for bonus)	age — if other than German, e	examination offered — if no	t every semester, informati	on on whether				
talk (6c) to 120	minutes)								
Langua	ge of a	ssessment: German or E	nglish							
Assess	ment o	ffered: In the semester ir	n which the course is	offered and in the su	ıbsequent semester					
Allocat	ion of p	olaces								
Additio	nal info	ormation								
Worklo	ad									
300 h										
Teachir	ng cycl	e								
		-								
Referre	d to in	LPO I (examination regulation	s for toaching dograa are	mmos)						
			is for teaching-degree progra	iiiiies)						
Modula		ve in								
Module										
	-	ee (1 major) Mathematics								
	-	ee (1 major) Mathematica ning degree Gymnasium	•	ion PLUS Flite Netwo	ork Bayaria (FNR) (a	516)				
		y course MINT Teacher E				510)				
		ee (1 major) Mathematics		Lettront Bavana (EN	_, (2010)					
	-			ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	020)				
	Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)									
		ee (1 major) Mathematica								
Master's degree (1 major) Computational Mathematics (2022)										
	-	ee (1 major) Mathematics								
Master'	's degre	ee (1 major) Mathematica	al Physics (2022)			Master's degree (1 major) Mathematical Physics (2022)				
Master's wi	ith 1 major	Mathematical Physics (2020)	JMU Würzburg •	generated 19-Apr-2025 • exa	ım. reg. da-	page 257 / 281				

exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title Abbrev					Abbreviation	
Resear	ch in G	roups - Non-linear Analy	/sis		10-M=GNLA-161-m	01
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem		
ECTS	1	od of grading	Only after succ. com			
10	1	rical grade				
Duratio						
1 seme		graduate				
Conten		gladdale	1			
Selected modern topics in non-linear analysis.						
Selecte	ea moa	ern topics in non-linear	analysis.			
Recom	mende	d previous knowledge:				
Depend	ding on	the content, basic and		from different areas	of analysis is require	ed. In case of
doubt,	it is rea	commended to consult t	he lecturer.			
Intende	ed lear	ning outcomes				
		ains insight into contem			alysis. He/She mas	ters advan-
ced tec	hnique	es in this field and can a	oply them to complex	problems.		
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	man)		
V (2) +	S (2)					
Module	e taugh	t in: German and/or Eng	lish			
		Sessment (type, scope, langu	age — if other than German, e	examination offered — if no	t every semester, informat	ion on whether
module is	s creditab	le for bonus)				
		o minutes)				
		ssessment: German or E ffered: In the semester i		offered and in the cu	beaquant comostor	
				onered and in the st	ibsequent semester	
Allocat		Jiaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination regulation	ns for teaching-degree progra	mmes)		
Module	e appea	ars in				
		ee (1 major) Mathematic	s (2016)			
		ee (1 major) Mathematic				
	Master's degree (1 major) Mathematical Hysics (2010) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)					016)
Supple	mentai	y course MINT Teacher E	Education PLUS, Elite N	Network Bavaria (EN	B) (2016)	
	-	ee (1 major) Mathematic	-			
		ning degree Gymnasium				020)
		y course MINT Teacher E		Network Bavaria (EN	B) (2020)	
	-	ee (1 major) Mathematic		`		
	-	ee (1 major) Computatio		2)		
waster	s aegr	ee (1 major) Mathematic	5 (2022)			I
Master's wi	ith 1 majo	r Mathematical Physics (2020)	_	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 259 / 281

Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Mathematical Data Science (2025)

Module	Module title Abbreviation					
Resear	ch in G	roups - Operator Algebr	as		10-M=GOPA-161-m	01
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
10		rical grade				
Duratio		Module level	Other prerequisites			
1 seme		graduate				
Conten		Sidduite				
Selected modern topics in operator algebras.						
Selecte	a moa	em topics in operator at	genias.			
Knowle	dge of	d previous knowledge: the contents of the moc mmended.	lules "Functional Anal	ysis" and "Algebra a	nd Dynamics of Qua	ntum Sy-
Intende	ed lear	ning outcomes				
	-	ains insight into contem this field and can apply		, .	ebras. He/She maste	ers advanced
Course	S (type, r	number of weekly contact hours,	, language — if other than Ge	rman)		
V (2) +	S (2)					
Module	e taugh	t in: German and/or Eng	lish			
		sessment (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	t every semester, informat	ion on whether
		o minutes)				
		ssessment: German or I				
		ffered: In the semester i	n which the course is	offered and in the su	ibsequent semester	'
Allocat	ion of _l	olaces				
			_			
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulatio	ns for teaching-degree progra	immes)		
Module	e appea	urs in				
Master	's degr	ee (1 major) Mathematic	cs (2016)			
	-	ee (1 major) Mathematic	· · ·			
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
	Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)					
	Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)					``
						020)
		y course MINT Teacher I ee (1 major) Mathematic		NELWOIK DAVAIIA (ENI	טז (2020)	
	-	ee (1 major) Mathematic ee (1 major) Computatio		2)		
	-	ee (1 major) Mathematic		-,		
						ا
Master's wi	ith 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 261 / 281

Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	Module title Abbreviation					
Resear	ch in G	roups - Lie Theory			10-M=GLIE-192-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mather	natics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	Duration Module level Other prerequisites					
1 seme	1 semester graduate					
Conten	Contents					
Selecte	d mod	ern topics in Lie Theory				
		d previous knowledge:				
		the contents of the mo	dule "Lie theory" is req	uired.		
		ning outcomes			• • • • •	
	-	ains insight into conter eld and can apply them		-	e/She masters adva	nced techni-
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V(2) + 1	• •	t in: German and/or En	alich			
		sessment (type, scope, lang		examination offered — if no	t every semester, informati	ion on whether
		le for bonus)				
		o minutes)				
		ssessment: German or ffered: in the semester		offered and in the su	ubsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	immes)		
Module	e appea	urs in				
Master	's degr	ee (1 major) Mathemati	cs (2019)			
Master	's teacl	ning degree Gymnasiun	n MINT Teacher Educat	ion PLUS, Elite Netw	ork Bavaria (ENB) (2	020)
	Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)					
Master's degree (1 major) Mathematical Physics (2020)						
Master's degree (1 major) Computational Mathematics (2022)						
	-	ee (1 major) Mathemati				
	Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023)					
		ee (1 major) Computatio	-			
	-	ee (1 major) Computati ee (1 major) Mathemati		'1 /		
	-	ning degree Gymnasiun		ion PLUS, Elite Netw	ork Bavaria (ENB) (20	025)
Master's wi	ith 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 263 / 281



Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	Module title Abbreviation						
Resear	ch in G	roups - Applied Differe	ntial Geometry		10-M=GADG-192-m	01	
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mather	natics)	Institute of Mathem	atics		
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
10	nume	rical grade					
Duratio	•	Module level	Other prerequisites				
1 seme	ı semester graduate						
Conten	ts						
Selecte	Selected modern topics in Applied Differential Geometry.						
Advanc al Geor	Recommended previous knowledge: Advanced knowledge of differential geometry is required, such as can be acquired in the module "Differenti- al Geometry". Knowledge of the contents of the modules "Introduction to Topology", "Geometric Mechanics", "Pseudo-Riemannian and Riemannian Geometry" and "Lie Theory" is also recommended.						
Intende	ed lear	ning outcomes					
		ains insight into conten d techniques in this fie				/She ma-	
Course	S (type, r	number of weekly contact hours	s, language — if other than Ge	rman)			
V (2) +	S (2)						
Module	e taugh	t in: German and/or En	glish				
		sessment (type, scope, lang	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether	
		le for bonus)					
		o minutes) ssessment: German or	Fnglish				
		ffered: in the semester		offered and in the su	ıbsequent semester		
Allocat	ion of _l	olaces					
Additio	nal inf	ormation					
Worklo	ad						
300 h							
Teachi	ng cvcl	e					
Referre	d to in	LPOI (examination regulation	ons for teaching-degree progra	ummes)			
Module	e appea	ars in					
		ee (1 major) Mathemati	cs (2019)				
	-			ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	020)	
	Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)						
	-	ee (1 major) Mathemati	-	-)			
	-	ee (1 major) Computatio		2)			
	Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022)						
	-	gram Mathematics (202	-				
		ee (1 major) Computatio	-	24)			
Mactaria	th	Mathematical Division (>	1841 18425	concreted in Annual -	um rog da	nogo c/c / - 0 -	
master s WI	itii 1 majo	r Mathematical Physics (2020)	-	generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 265 / 281	



Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	Module title Abbreviation					
Resear	ch in G	roups - Mathematical P	hysics		10-M=GMAP-192-m	01
Module	coord	inator		Module offered by		
Dean of	fStudi	es Mathematik (Mathen	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	l Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Selected modern topics in Mathematical Physics.						
Depend	ling on	d previous knowledge: the content, basic and quired. In case of doub				ifferential
Intende	ed lear	ning outcomes				
	-	ains insight into conten ques in this field and ca			l Physics. He/She m	asters ad-
Course	S (type, r	umber of weekly contact hours	, language — if other than Ge	rman)		
V (2) + S Module	• •	t in: German and/or Eng	glish			
		sessment (type, scope, langi	-	examination offered — if no	t every semester, informati	on on whether
		le for bonus)	age in earler and reenhan,			
talk (6c	to 120	o minutes)				
		ssessment: German or		66 1 1 1 1		
		ffered: in the semester	in which the course is	offered and in the su	ibsequent semester	
Allocat	ion of p	llaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h			_			
Teachir	ıg cycl	8				
Referre	d to in	LPO I (examination regulation	ns for teaching-degree progra	ammes)		
Module	e appea	ars in				
	-	ee (1 major) Mathemati	-			
		ning degree Gymnasium				020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)						
Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022)						
	-	ee (1 major) Mathemati				
	-	ee (1 major) Mathemati				
	-	gram Mathematics (202	•			
	-	ee (1 major) Computatio		.4)		
Master'	s degr	ee (1 major) Mathemati	cs (2024)			
Master's wi	th 1 majo	Mathematical Physics (2020)	-	9 generated 19-Apr-2025 • exa (120 ECTS) Mathematische P	-	page 267 / 281



Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module	Module title Abbreviation					
Study	Group I	Aodern Differential Geom	netry		11-AG-MDG-161-m01	
Modul	e coord	inator		Module offered by	1	
chairpe	erson o	f examination committee		Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duration Module level Other prerequisites						
1 seme	ster	graduate				
Conten	Its					
		o current questions of mo y of the required fundam			on for a Master's thesis in this	
Intend	ed lear	ning outcomes				
		nave advanced knowledg s. They are able to summ			ave gained insights into current ation.	
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	man)		
S (4) Module	e taugh	t in: German or English				
		s essment (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	ot every semester, information on whether	
Langua	age of a	o minutes) ssessment: German and, ffered: In the semester in		offered and in the su	ubsequent semester	
	ion of p					
Additio	onal inf	ormation				
Worklo	ad					
300 h						
-	ng cycl	e				
	- /					
Referre	ed to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
		-	• •			
Module	e appea	irs in				
		ee (1 major) Mathematica	Il Physics (2016)			
	-	ee (1 major) Mathematica	-			
Master	's degr	ee (1 major) Mathematica	ll Physics (2022)			

Module	Module title Abbreviation					
Study	Group S	Symplectic and Poisson (Geometry		11-AG-SPG-161-m01	
Modul	e coord	inator		Module offered by	<u>I</u>	
chairpe	erson o	f examination committee		Faculty of Physics a	and Astronomy	
ECTS Method of grading Only after succ. co			Only after succ. con	npl. of module(s)		
10 numerical grade						
Duration Module level Other prerequisites						
1 seme	ster	graduate				
Conten	Its					
		o current questions of syn area. Summary of the req			as a preparation for a Master's esentation.	
Intend	ed lear	ning outcomes				
		have advanced knowledg topics. They are able to s			nd have gained insights into cur- sentation.	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ge	rman)		
S (4) Module	e taugh	t in: German or English				
Metho	d of ass	Sessment (type, scope, langua	ge — if other than German,	examination offered — if no	ot every semester, information on whether	
		le for bonus)				
		o minutes) ssessment: German and,	/or English			
Assess	ment o	ffered: In the semester in	which the course is	offered and in the su	ubsequent semester	
Allocat	ion of p	olaces				
	-					
Additio	onal inf	ormation				
	-					
Worklo	ad					
300 h						
Teachi	ng cycl	е				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	e appea	ars in				
	-	ee (1 major) Mathematica	•			
	•	ee (1 major) Mathematica				
Master	's degr	ee (1 major) Mathematica	al Physics (2022)			

Modul	Module title Abbreviation					
Study	Group (Operator Algebras and Re	epresentation Theory	1	11-AG-OAD-161-m01	
Modul	e coord	inator		Module offered by		
chairpe	erson o	f examination committee	!	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duration Module level Other prerequisites						
1 seme	ster	graduate				
Conter	Its					
		o current questions of op d fundamental topics in a			ter's thesis in this area. Summary	
Intend	ed lear	ning outcomes				
		have advanced knowledg able to summarise their			nsights into current research to-	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ge	rman)		
S (4) Module	e taugh	t in: German or English				
		sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether	
Langua	age of a	o minutes) ssessment: German and, ffered: In the semester ir		offered and in the s	ubsequent semester	
	ion of J					
Additio	onal inf	ormation	-			
Worklo	ad					
300 h						
	ng cycl	e				
Referre	ed to in	LPO I (examination regulation	s for teaching-degree progra	ummes)		
			·			
Modul	e appea	urs in				
		ee (1 major) Mathematica	al Physics (2016)			
	Master's degree (1 major) Mathematical Physics (2020)					
Master	's degr	ee (1 major) Mathematica	al Physics (2022)			

Module	e title				Abbreviation
Study	Group H	lopf Algebras			11-AG-HAL-161-m01
Module	e coord	inator		Module offered by	I
chairpe	erson o	f examination committee		Faculty of Physics a	ind Astronomy
ECTS Method of grading Only after succ. c			Only after succ. con	npl. of module(s)	
10					
Duration Module level Other prerequisites					
1 seme	ster	graduate			
Conten	Its				
		o current questions of Ho undamental topics in a se		aration for a Master's	s thesis in this area. Summary of
Intend	ed lear	ning outcomes			
		nave advanced knowledg to summarise their know			nts into current research topics.
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	rman)	
S (4) Module	e taugh	t in: German or English			
		eessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether
Langua	age of a) minutes) ssessment: German and, ffered: In the semester in		offered and in the cu	because t competer
Allocat					ibsequent semester
		haces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
-	ng cycl	e			
	- /				
Referre	ed to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
		-	•		
Module	e appea	irs in			
		ee (1 major) Mathematica	ll Physics (2016)		
	-	ee (1 major) Mathematica			
Master	's degr	ee (1 major) Mathematica	ll Physics (2022)		

Module	Module title Abbreviation					
Study	Study Group Conformal Field Theory 11-AG-KFT-161-mo1					
Module coordinator Mode				Module offered by		
chairperson of examination committee				Faculty of Physics a	ind Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	Its					
		o current questions of con ne required fundamental			a Master's thesis in this area.	
Intend	ed lear	ning outcomes				
		have advanced knowledg re able to summarise the		, .	ed insights into current research	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	rman)		
S (4) Module	e taugh	t in: German or English				
		sessment (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	ot every semester, information on whether	
Langua	age of a	o minutes) ssessment: German and, ffered: In the semester in		offered and in the su	ubsequent semester	
	ion of p					
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in					
Master	Master's degree (1 major) Mathematical Physics (2016)					
	Master's degree (1 major) Mathematical Physics (2020)					
Master	's degr	ee (1 major) Mathematica	Il Physics (2022)			

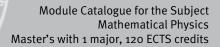
Module title Abbreviation						
Study	Study Group Statistical Mechanics 11-AG-STM-161-m01					
Module coordinator Module offered by						
chairperson of examination committee				Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duration Module level Other prerequisites						
1 seme	ster	graduate				
Conten	Its					
		o current questions of sta ne required fundamental			Master's thesis in this area.	
Intend	ed lear	ning outcomes				
		have advanced knowledg re able to summarise the			ed insights into current research	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ge	rman)		
S (4) Module	e taugh	t in: German or English				
		sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether	
Langua	age of a	o minutes) ssessment: German and, ffered: In the semester in		offered and in the si	ibsequent semester	
Allocat						
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
	Master's degree (1 major) Mathematical Physics (2016)					
	Master's degree (1 major) Mathematical Physics (2020)					
Master	's degr	ee (1 major) Mathematica	Il Physics (2022)			

Module title Abbreviation						
Study	Study Group Quantum Field Theory 11-AG-QFT-161-mo1					
Module coordinator Modul				Module offered by		
chairperson of examination committee				Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duration Module level Other prerequisites						
1 seme	ster	graduate				
Conten	Its					
		o current questions of qu quired fundamental topic			Master's thesis in this area. Sum-	
Intend	ed lear	ning outcomes				
		have advanced knowledg re able to summarise the			ed insights into current research	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Gei	rman)		
S (4) Module	e taugh	t in: German or English				
		sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether	
Langua	age of a	o minutes) ssessment: German and, ffered: In the semester in		offered and in the su	ubsequent semester	
Allocat						
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in					
Master	Master's degree (1 major) Mathematical Physics (2016)					
	Master's degree (1 major) Mathematical Physics (2020)					
Master	's degr	ee (1 major) Mathematica	Il Physics (2022)			

Module	Module title Abbreviation					
Study	Study Group Riemannian Geometry 11-AG-RGE-161-mo1					
Module coordinator Module offered by						
chairperson of examination committee				Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	numerical grade					
Duration Module level Other prerequisites			Other prerequisites			
1 seme	ster	graduate				
Conten	Its					
		o current questions of Rie ne required fundamental			Master's thesis in this area.	
Intende	ed lear	ning outcomes				
		have advanced knowledg re able to summarise the			ed insights into current research	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Gei	rman)		
S (4) Module	e taugh	t in: German or English				
		sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether	
Langua	age of a	o minutes) ssessment: German and, ffered: In the semester in		offered and in the su	ibsequent semester	
Allocat						
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in					
	Master's degree (1 major) Mathematical Physics (2016)					
	Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Mathematical Physics (2022)					
Master	's degr	ee (1 major) Mathematica	Il Physics (2022)			

Module	Module title Abbreviation						
Study	Study Group Mathematical Physics 11-AG-MPH-161-m01						
Module coordinator Module offered by							
chairpe	erson o	f examination committee		Faculty of Physics a	and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
10	numerical grade						
Duration Module level Other prerequisites			Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
		o current questions of Ma ne required fundamental			a Master's thesis in this area.		
Intende	ed lear	ning outcomes					
		nave advanced knowledg re able to summarise the			ed insights into current research		
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Gei	rman)			
S (4) Module	e taugh	t in: German or English					
		s essment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether		
Langua	ige of a	o minutes) ssessment: German and, ffered: In the semester in		offered and in the su	ibsequent semester		
Allocat							
Additio	nal inf	ormation					
Worklo	ad						
300 h							
Teachi	ng cycl	e					
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in						
	Master's degree (1 major) Mathematical Physics (2016)						
	Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Mathematical Physics (2022)						
Master	's degr	ee (1 major) Mathematica	II Physics (2022)				





Thesis (50 ECTS credits)

Module	Module title Abbreviation					
Profess	Professional Specialization Mathematical Physics 11-FS-MP-161-m01					
Module coordinator Module offered by						
chairperson of examination committee				Faculty of Physics a	ind Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	(not) s	(not) successfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
		o current questions of a s a. Summary of the require			a preparation for a Master's the- ntation.	
Intende	ed lear	ning outcomes				
vance t	the in		ter's thesis. They kno		ical Physics with a special rele- of research in this area and are	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Gei	rman)		
		t in: German or English Sessment (type, scope, langua	ge — if other than German, '	examination offered — if no	ot every semester, information on whether	
module is	s creditab	le for bonus)				
•		o minutes) ssessment: German and,	/or English			
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in					
	Master's degree (1 major) Mathematical Physics (2016)					
	Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Mathematical Physics (2022)					
Master	's degr	ee (1 major) Mathematica	al Physics (2022)			

Module	Module title Abbreviation						
Scientific Methods and Project Management Mathematical Physics 11-MP-MP-161-mo1							
Module	e coord	inator		Module offered by			
chairperson of examination committee				Faculty of Physics a	and Astronomy		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
10	(not) s	successfully completed		-			
Duration Module level Other prerequisites							
1 seme	ster	graduate					
Conten	ts						
		o the methods of scientif Aathematical Physics. Wr			project planning. Application to anned Master's thesis.		
Intend	ed lear	ning outcomes					
ster's t	hesis. 1		oject plan for the Ma		e to the intended topic of the Maplan the required work. They are		
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)			
R (6) Module	e taugh	t in: German or English					
Metho	d of ass	sessment (type, scope, langua	ge — if other than German, e	examination offered — if n	ot every semester, information on whether		
		le for bonus)					
		o minutes) ssessment: German and,	or English				
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
300 h							
Teachi	ng cycl	e					
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master's degree (1 major) Mathematical Physics (2016)							
Master's degree (1 major) Mathematical Physics (2020)							
Master	's degr	ee (1 major) Mathematica	Il Physics (2022)				

Module title Abbreviation						
Master Thesis Mathematical Physics 11-MA-MP-161-mo1						
Module coordinator				Module offered by	I	
chairperson of examination committee			!	Faculty of Physics a	and Astronomy	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
30	nume	rical grade				
Durati	on	Module level	Other prerequisites			
1 semester graduate				l completion of certain modu- opic a prerequisite for the assign-		
Conter	nts					
		endent processing of a ta cientific aspects; writing		nematical Physics, e	specially according to known pro	
Intend	ed lear	ning outcomes				
		are able to independently ds and scientific aspects			ics, especially according to paper.	
Course	es (type, 1	number of weekly contact hours, I	anguage — if other than Gei	rman)	· · ·	
Νο cou	urses as	signed to module				
		S essment (type, scope, langua vle for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether	
Regist	ration a	is (750 to 900 hours total nd assignment of topic ir ssessment: German and	n consultation with su	upervisor.		
Alloca	tion of	places				
Additi	onal inf	ormation				
Time to	o comp	lete: 6 months.				
Worklo	oad					
900 h						
Teaching cycle						
Referr	ed to in	LPOI (examination regulation	s for teaching-degree progra	immes)		
Modul	Module appears in					
Maste	r's degr	ee (1 major) Mathematica	al Physics (2016)			
	Master's degree (1 major) Mathematical Physics (2020)					
Maste	r's degr	ee (1 major) Mathematica	al Physics (2022)			