

Module Catalogue

for the Subject

Mathematical Data Science

as a Master's with 1 major with the degree ""

(120 ECTS credits)

Examination regulations version: 2025 Responsible: Faculty of Mathematics and Computer Science Responsible: Institute of Mathematics

JMU Würzburg • generated 14-Dez-2024 • exam. reg. data record 88|l22|-|-|H|2025



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The subject is divided into

section / sub-section	ECTS credits	starting page
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Content and Objectives of the Programme

The Master programme Mathematical Data Science is offered by the Department of Mathematics and Computer Science as part of a consecutive Bachelor and Master programme. It is a research-oriented programme with the degree "Master of Science" (M.Sc.) which constitutes a further degree qualifying for profession and research.

The aim of the course is to provide students with in-depth knowledge of various sub-areas of mathematics and computer science and their relevance to data science, which includes in particular insights into interdisciplinary aspects as well as a sound knowledge of mathematical methods for analyzing and developing new data science techniques, including the necessary ones Abstract ability and analytical thinking, a high level of problem-solving skills and the ability to structure complex relationships, with which the course lays the basis for working as a responsible mathematician in interdisciplinary and international teams to participate successfully in research, industry and business.

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)):

??-???-2025 (2025-??)

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



Compulsory Courses

(15 ECTS credits)

Module	Module title Abbreviation			Abbreviation	
Mathematical Data Science and Machine Learning10-M=AMML-252-m01			10-M=AMML-252-m01		
Module	coord	inator		Module offered by	
				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				
Conten	ts				
Intende	ed learr	ning outcomes			
Courses	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) + I	Ü (2)				
Module	e taugh	t in: German and/or Engl	ish		
Methoo module is	d of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writte b) oral e c) oral e Langua credital	en exar examin examin ge of a ble for	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ssessment: German or Er bonus	20 minutes, usually c ach (approx. 20 minu of 2, 15 minutes per ca nglish	:hosen) or ites) or andidate)	
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teachir	ng cycl	e			
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	ins in			
keinem	Studie	engang zugeordnet			

Module	Module title Abbreviation			Abbreviation	
Machin	Machine Learning 10-AI=ML-242-mo1			10-Al=ML-242-m01	
Module	Module coordinator Module offered by				
Dean of	Dean of Studies Informatik (Computer Science) Institute of Computer Science			er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Founda dels, ap ning. Si	tions in oproacl upervis	n the following areas: The nes and algorithms, and t red and unsupervised lea	eoretical knowledge a their practical implen Irning methods.	and practical experie nentation for the clas	nce in machine learning. Mo- ssical problems of machine lear-
Intende	ed learr	ning outcomes			
The stu machin propria	dents ł e learn te metł	nave theoretical and prac ing. They are able to solv nods. They have experien	tical knowledge of ty ve practical problems ice in the application	pical models, metho in the field of machi or implementation o	ods and algorithms in the field of ine learning with the help of ap- of machine learning approaches.
Course	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) +	Ü (2)				
Module	taugh	t in: German and/or Engli	ish		
Methoo module is	l of ass creditab	s essment (type, scope, langua; le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
Written If annou examin prox. 15 Langua credital	examin unced l ation o minut ge of a ole for	nation (approx. 60 to 120 by the lecturer at the beg f one candidate each (ap es per candidate). ssessment: German and/ bonus	o minutes) inning of the course, pprox. 20 minutes) or /or English	the written examina an oral examination	tion may be replaced by an oral in groups of 2 candidates (ap-
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
150 h					
Teachir	ng cycl	9			
Teachir	ng cycle	e: every year, winter seme	ester		
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	irs in			
Master'	s degre	ee (1 major) Artificial Inte	lligence (2024)		



Compulsory Electives

(75 ECTS credits)





Subfield Optimization

(10 ECTS credits)

Module	dule title Abbreviation					
Selecte	elected Topics in Optimization 10-M=VOPT-161-mo1			01		
Module	Module coordinator Module offered by					
Doan o	f Studie	nator	matica	Institute of Mathem	atics	
					Idlics	
ECIS	Metho	od of grading	Only after succ. con	ipi. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Selecte me the	ed topic ory, op	s in optimization, e.g. timization with differer	inner point methods, s itial equations.	emidefinite program	ıs, non-smooth optiı	mization, ga-
Intende	ed lear	ning outcomes				
The stu conterr	ident is	acquainted with adva research questions in	nced methods in contir continuous optimizatic	uous optimization. n.	He gains the ability t	to work on
Course	S (type, r	number of weekly contact hour	s, language — if other than Ger	man)		
V (4) +	Ü (2)					
Module	e taugh	t in: German and/or En	glish			
Metho	d of ass	sessment (type, scope, lang	guage — if other than German, o	examination offered — if no	t every semester, informat	ion on whether
module is	s creditab	le for bonus)				
b) oral c) oral Langua Assess credita	examin examin ige of a ment o ble for	ation of one candidate ation in groups (group ssessment: German or ffered: In the semester bonus	e each (approx. 20 minu s of 2, 15 minutes per c English in which the course is	offered and in the su	ubsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
300 h						
Teachi	ng cycl	۵				
Teachin	is cyce					
	1					
Referre	a to in	LPOI (examination regulation	ons for teaching-degree progra	mmes)		
Module	e appea	ars in				
Master	's degr	ee (1 major) Mathemati	cs (2016)			
Master	's degr	ee (1 major) Economati	nematics (2016)			
Master	's degr	ee (1 major) Mathemati	cal Physics (2016)			
Master	's toach	ee (1 major) Computati	onal Mathematics (201 m MINT Toochor Educat	on PLUS Elito Notw	ork Bayaria (ENB) (a	016)
Sunnle	mentai	we degree Gymnasiun V course MINT Teacher	Fducation PILIS Flite	Network Bavaria (FN	B) (2016)	010)
Master	's degr	ee (1 major) Computati	onal Mathematics (201	9)	2, (2010)	
Master	's degr	ee (1 major) Mathemati	ics (2019)	//		
Master	's teacl	ning degree Gymnasiur	n MINT Teacher Educat	on PLUS, Elite Netwo	ork Bavaria (ENB) (2	020)
Supple	mentai	y course MINT Teacher	Education PLUS, Elite I	Network Bavaria (EN	B) (2020)	
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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)

Module	Module title Abbreviation		Abbreviation		
Basics	in Opti	mization			10-M=AOPT-161-m01
Module	coord	inator		Module offered by	
Dean of	fStudie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate			
Conten	ts				
Fundam mality, mics.	nental i restrict	methods and techniques ted optimization, exampl	in continuous optim es and applications i	ization, unrestricted n natural and engine	optimization, conditions for opti- eering sciences as well as econo-
Intende	ed leari	ning outcomes			
The stu ses and	dent kı I can d	nows the fundamental m ecide which method is th	ethods of continous o e most suitable in ap	optimization, can juc	lge their strengths and weaknes-
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) + Í Module	Ü (2) taugh	t in: German and/or Engl	ish		
Method	l of ass	essment (type, scope, langua	ge — if other than German, e	examination offered — if no	t every semester, information on whether
module is	creditab	le for bonus)			
a) writte b) oral e c) oral e Langua Assessi credital	en exar examin examin ge of a ment o ble for	mination (approx. 90 to 1 lation of one candidate e ation in groups (groups o ssessment: German or Ei ffered: In the semester in bonus	20 minutes, usually o ach (approx. 20 minu of 2, 15 minutes per ca nglish which the course is	chosen) or ites) or andidate) offered and in the su	ıbsequent semester
Allocati	ion of p	olaces			
	•				
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teachir	ng cvcl	6			
	<u> </u>				
Referre	d to in	LPO I (examination regulation)	s for teaching-degree progra	mmes)	
Module	appea	ars in			
Master'	s degr	ee (1 major) Mathematics	; (2016)		
Master'	s degr	ee (1 major) Economathe	matics (2016)		
Master'	s degr	ee (1 major) Mathematica	l Physics (2016)		
Master'	s degr	ee (1 major) Computation	al Mathematics (201	6)	
Master'	s teach	ning degree Gymnasium l	WINT Teacher Education	on PLUS, Elite Netwo	Drk Bavaria (ENB) (2016) B) (2016)
Master'	s degri	e (1 major) Computation	al Mathematics (201	o)	ען (2010)
Master'	s degr	ee (1 major) Mathematics	5 (2019)	7/	
Master'	s teach	ning degree Gymnasium I	MINT Teacher Educati	on PLUS, Elite Netwo	ork Bavaria (ENB) (2020)

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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)



Subfield Applied Mathematics

(20 ECTS credits)

Module	Module title Abbreviation			Abbreviation	
Advanced Topics in Mathematics of Machine Learning 10-M=VMML-252-mo1			10-M=VMML-252-m01		
Module	e coord	inator		Module offered by	
				Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster				
Conten	ts				
Intende	ed learr	ning outcomes			
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (3) +	Ü (1)				
Module	e taugh	t in: German and/or Engli	ish		
Method	d of ass	essment (type, scope, langua	ge — if other than German, e	examination offered — if no	t every semester, information on whether
module is	creditab	le for bonus)			
b) oral	en exar examin	ation of one candidate e	ach (approx, 15 minu	tes) or	
c) oral e	examin	ation in groups (groups c	of 2, 10 minutes per c	andidate)	
Langua	ge of a	ssessment: German or Er	nglish	<i>.</i>	
Assess	ment o ble for	ffered: In the semester in	which the course is	offered and in the su	ibsequent semester
Allocat					
Additio	nal info	ormation			
Worklo	ad				
150 h					
Teachir	ng cycl	9			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	rs in			
keinem	Studie	ngang zugeordnet			

Module	Abbreviation Abbreviation					
Mather	Nathematical Continuum Mechanics 10-M=VKOM-161-m01			01		
Module	Module coordinator Module offered by					
Dean o	f Studi	es Mathematik (Mather	natics)	Institute of Mathem	atics	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Partial	differe	ntial equations and/or	variational methods in	the context of contir	nuum mechanics.	
Recom Basic k Equatio	mende nowlea ons" is	d previous knowledge: dge from the modules " recommended, as well	Ordinary Differential Ec as basic knowledge of	quations" and "Introc functional analysis.	luction to Partial Dif	ferential
Intende	ed lear	ning outcomes				
The stu main fi	dent m elds of	asters the mathematic application.	al methods in mathem	atical continuum me	chanics and knows a	about their
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V (3) + Module	Ü (1) e taugh	t in: German and/or En	glish			
Method module is	d of ass creditab	sessment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
b) oral c) oral Langua Assess	examir examir examin ige of a ment o	action of one candidate action in groups (groups ssessment: German or ffered: In the semester	each (approx. 15 minu s of 2, approx. 10 minu English in which the course is	offered and in the su	ıbsequent semester	
Allocat	ion of	Diaces				
Additional information						
Worklo	ad					
150 h						
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	ummes)		
Module	e appea	ars in				
Master	's degr	ee (1 major) Mathemati	cs (2016)			
Master	's degr	ee (1 major) Mathemati	cal Physics (2016)			
Master	's degr	ee (1 major) Computati	onal Mathematics (201	6)		
Master	's teac	hing degree Gymnasiur	n MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	o16)
Supple	menta	ry course MINT Teacher	Education PLUS, Elite	Network Bavaria (ENI	B) (2016)	
Master	's degr	ee (1 major) Computati	onal Mathematics (201	9)		
Master	's degr	ee (1 major) Mathemati	cs (2019)			
Master	's teac	ning degree Gymnasiur	n MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	020)
Master's wi (2025)	ith 1 majo	r Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	. reg. data re- ience - 2025	page 18 / 148

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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)

Module	Module title Abbreviation					
Applied	l Analy	sis			10-M=AAAN-161-mo)1
Module	e coord	inator		Module offered by		
Dean of	f Studi	es Mathematik (Mather	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					
In-dept theory of particul theory of Recomm	h study of Hilbo lar FEN of ellip mende	y of functional analysis ert spaces and Fourier a I methods), principles o tic, parabolic and hype d previous knowledge:	and operator theory, S inalysis, spectral theor of functional analysis, f rbolic partial differentia	obolev spaces and p y and quantum mech unction spaces, emb al equations with me	partial differential eq hanics, numerical m pedding theorems, c ethods from function	uations, ethods (in ompactness, al analysis.
Faiiiia					Jiimended.	
The stu to estal physics	dent is blish a and o	acquainted with the fu connection between hi ther natural and engine	ndamental notions, m s/her acquired skills a ering sciences.	ethods and results o nd other branches o	f higher analysis. He f mathematics and q	/She is able uestions in
Course	S (type, r	number of weekly contact hours	s, language — if other than Gei	rman)		
V (4) + Module	Ü (2) e taugh	t in: German and/or En	glish			
Method	d of ass	sessment (type, scope, lang	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
module is	creditab	le for bonus)				
a) writte b) oral e c) oral e Langua Assess credita	en exal examir examin ge of a ment o ble for	mination (approx. 90 to nation of one candidate ation in groups (groups ssessment: German or ffered: In the semester bonus	120 minutes, usually each (approx. 20 minu of 2, 15 minutes per c English in which the course is	chosen) or utes) or andidate) offered and in the su	ıbsequent semester	
Allocat	ion of I	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachir	ng cvcl	e				
	<u> </u>					
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	immes)		
Module	appea	urs in				
Master	's degr	ee (1 major) Mathemati	cs (2016)			
Master	's degr	ee (1 major) Physics (20	016)			
Master	's degr	ee (1 major) Economath	ematics (2016)			
Master	's degr	ee (1 major) Mathemati	cal Physics (2016)			
master	s degr	ee (1 major) Computatio	onal Mathematics (201	6)		/
waster's wi (2025)	іп 1 тајо	mathematical Data Science	JMU Würzburg • ge cord Master (120	ECTS) Mathematical Data Sc	i. reg. data re- ience - 2025	page 20 / 148

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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)

Numeric of Large Systems of Equations 10-M=ANGG-161-m01 Module coordinator Module offered by Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s)			
Module coordinator Module offered by Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s)			
Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s)			
ECTS Method of grading Only after succ. compl. of module(s)			
intra or grading only area such compared in addition			
10 numerical grade			
Duration Module level Other prerequisites			
1 semester graduate			
Contents			
Discretisation of elliptic differential equations, classical iteration methods, preconditioners, multigrid methods.			
Recommended previous knowledge: Basic knowledge of numerical mathematics, such as that acquired in the modules "Numerical Mathematics 1" and "Numerical Mathematics 2", is required. Knowledge of the contents of the module "Basics in Optimization" is also recommended.			
Intended learning outcomes			
The student is acquainted with the most important methods for solving large systems of equations, and knows the most efficient way to solve a given system of equations.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (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 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			
200 h			
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 testing degree (1 major) Computational Mathematics (2010) Master's teaching degree Compacium MINT Teacher Education DLUS, Elite Network Pavaria (ENP) (2016)			
Supplementary course MINT Teacher Education DLUS Elite Network Reveria (END) (2016)			
Master's degree (1 major) Computational Mathematics (2010)			
Master's with 1 major Mathematical Data Science JMU Würzburg • generated 14-Dez-2024 • exam. reg. data re-			

UNIVERSITÄT WÜRZBURG

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)

Module title Abbreviation								
Numeri	Numeric of Partial Differential Equations 10-M=VNPE-161-m01)1		
Module coordinator				Module offered by	_			
Dean of Studies Mathematik (Mathema			natics)	s) Institute of Mathematics				
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)				
10 numerical grade								
Duratio	n	Module level	Other prerequisites					
1 seme	ster	graduate						
Conten	ts	0	ļ					
Types o (numer discont Recom We reco red in t	of partia ical me tinuous mendee ommen he moo	al differential equations thods for elliptic, paral Gelerkin finite elemen d previous knowledge: d basic knowledge of f	s, qualitative properties bolic and hyperbolic pa ts method, finite differ unctional analysis and	s, finite differences, f artial differential equ ences and finite volu partial differential e d "Applied Analysis"	finite elements, erro ations; finite elemen ume methods). quations, such as ca	r estimates nts method, an be acqui-		
Intondo	d loar	aing outcomes			•			
The stu	dent is	acquainted with advar		etising partial difford	ntial equations			
Course		www.hor.of.wookly.contact.hour	language if other than Car		ential equations.			
V (4) +	Ü (2)	t in: German and/or En	plich	ilidi)				
Method	d of ass		uago — if other than Corman	examination offered — if no	t ovory comostor informati	on on whothor		
module is	s creditab	le for bonus)	uage — II other than German, G	examination onered — If no	t every semester, mormati	on on whether		
a) writte b) oral c) oral e Langua Assess credita	 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 							
Allocat	ion of p	olaces						
Additio	nal inf	ormation						
Worklo	ad							
300 h								
Teachir	ng cvcl	6						
	0 . /	-						
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)				
Module appears in								
Master's degree (1 major) Mathematics (2016)								
Master'	's degr	ee (1 major) Physics (20	016)					
Master	's degr	ee (1 major) Economath	ematics (2016)					
Master's degree (1 major) Mathematical Physics (2016)								
Master	Master's degree (1 major) Computational Mathematics (2016)							
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)								
Supple	mentar	y course MINT Teacher	Education PLUS, Elite I	Network Bavaria (EN	B) (2016)			
Master's wi (2025)	ith 1 majoi	Mathematical Data Science	JMU Würzburg • ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	ı. reg. data re- ience - 2025	page 24 / 148		

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

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

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WÜRZBURG

Module title Abbreviation								
Optimal Control 10-M=VOST-161-m01						91		
Module coordinator				Module offered by				
Dean of Studies Mathematik (Mathema			natics)	ics) Institute of Mathematics				
ECTS	Metho	od of grading	Only after succ. com	Only after succ. compl. of module(s)				
5	nume	rical grade		· · · · · ·				
Duratio	n	Module level	Other prerequisites					
1 seme	ster	graduate						
Conten	te	Sidduite	l					
Basics optima Recomm We reco quired the con Intende The stu rary res Courses V (3) + I Module Methoo a) writte	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 ac- quired 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 contempo- rary 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)							
b) oral c c) oral c Langua Assess credita	examin examin ge of a ment o ble for	action of one candidate ation in groups (groups ssessment: German or ffered: In the semester bonus	each (approx. 15 minu of 2, approx. 10 minut English in which the course is	tes) or tes per candidate) offered and in the su	ıbsequent semester			
Allocat	ion of p	olaces						
Additio	nal inf	ormation						
Worklo	ad							
150 h								
Toochir		•						
Teacini	ig cycl	6						
Referred to in LPO I (examination regulations for teaching-degree programmes)								
		•						
Module	e appea	irs in						
Master	s degri	ee (1 major) Mathemati	CS (2016)					
master's degree (1 major) Economatnematics (2016) Master's degree (1 major) Mathematical Physics (2016)								
Master	Master's degree (1 major) Malifematical MySICS (2010) Master's degree (1 major) Computational Mathematics (2016)							
Master's teaching degree Gymnasium MINT Teacher Education PLUS. Elite Network Bavaria (ENB) (2016)								
Supple	mentar	y course MINT Teacher	Education PLUS, Elite I	Network Bavaria (EN	B) (2016)	·		
Master's wi (2025)	th 1 majoi	Mathematical Data Science	JMU Würzburg • ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	. reg. data re- ience - 2025	page 26 / 148		

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)

Julius-Maxi

UNIVERSITÄT

WÜRZBURG

Module title					Abbreviation	
Inverse	Inverse Problems 1 10-M=VIPR-222-m01					
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathema			natics)	Institute of Mathematics		
ECTS Method of grading Only after succ. compl. of module(s)						
5	numei	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Linear sation Recom	operato method mendeo	r equations, ill-posed p ls, examples of ill-pose d previous knowledge:	oroblems, regularisatic d problems.	on theory, Tikhonov r	egularisation, iterati	ve regulari-
Basic k ded.	nowled	lge of functional analys	is, such as that taught	in the module "Func	tional Analysis", is r	recommen-
Intende	ed learr	ning outcomes				
The stu thods a	ident ca and exa	an judge whether a give mine them regarding st	n problem is well pose ability and convergene	ed or ill posed. He/Sh ce, and is familiar wit	ne can apply regular th selected inverse p	isation me- problems.
Course	S (type, n	umber of weekly contact hours	, language — if other than Ger	rman)		
V (3) + Module	Ü (1) e taugh	t in: German and/or Eng	glish			
Metho module is	d of ass s creditab	e ssment (type, scope, langu le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
a) writt b) oral c) oral Langua Assess credita	en exar examin examin ige of a ment o ble for l	nination (approx. 60 to ation of one candidate ation in groups (groups ssessment: German or I ffered: In the semester bonus	90 minutes, usually c each (approx. 15 minu of 2, approx. 10 minu English in which the course is	hosen) or ites) or tes per candidate) offered and in the su	bsequent semester	
Allocat	ion of p	olaces				
Additio	onal info	ormation				
Worklo	ad					
150 h						
Teachi	ng cycle	2				
Referre	ed to in	LPO I (examination regulation	ns for teaching-degree progra	mmes)		
Module appears in						
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 w (2025)	ith 1 major	Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sci	. reg. data re- ence - 2025	page 28 / 148



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

Module title					Abbreviation	
Inverse	Inverse Problems 2 10-M=VIP2-222-m01					
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathemati			atics)	Institute of Mathematics		
ECTS	ECTS Method of grading Only after succ. co			npl. of module(s)		
5	numeri	cal grade				
Duratio	on l	Module level	Other prerequisites			
1 seme	ester l	undergraduate				
Conten	nts					
Variatio	onal regu	ularisation methods, so	ource conditions, non-	linear operator equa	tions.	
Recom Basic k ded, as	mended knowledg s well as	previous knowledge: ge of functional analysi the contents of the mo	s, such as that taught dule "Inverse Problen	in the module "Func 15 1" if applicable.	tional Analysis", is r	ecommen-
Intende	ed learni	ing outcomes				
The stu They ha and co	udents un ave the a nvergend	nderstand the particula ability to apply variation ce. They gain deeper kr	r difficulties of nonlin nal regularisation met nowledge in selected i	ear problems and kr hods and to examine nverse problems.	now solution method e them with respect t	ls for those. to stability
Course	es (type, nu	mber of weekly contact hours,	language — if other than Ger	rman)		
V (3) + Module	Ü (1) e taught	in: German and/or Eng	lish			
Metho module is	d of asse	essment (type, scope, langu for bonus)	age — if other than German, o	examination offered — if no	t every semester, informati	on on whether
b) oral c) oral Langua Assess credita	examina examina examina age of as sment off able for b	ition of one candidate of tion in groups (groups sessment: German or E fered: In the semester i onus	each (approx. 15 minu of 2, approx. 10 minu nglish n which the course is	nosen) or tes) or tes per candidate) offered and in the su	ıbsequent semester	
Allocat	tion of pl	aces				
Additio	onal info	rmation				
Worklo	bad					
150 h						
Teachi	ng cvcle					
Referre	ed to in L	POI (examination regulation	ns for teaching-degree progra	mmes)		
Module appears in						
Master's degree (1 major) Computational Mathematics (2022)						
Master	r's degree	e (1 major) Mathematic	s (2022)			
Master	r's degree	e (1 major) Mathematic	al Physics (2022)			
Master	r's degree	e (1 major) Economathe	ematics (2022)			
exchan	nge progr	am Mathematics (202	3)	、 、		
Master's degree (1 major) Computational Mathematics (2024)						
Master's w	s uegree	e (1 Major) Mathematic Aathematical Data Science	5 (2024) IMII Würzburg • g	enerated 1/-Dez-2024 • exam	reg data re-	nage 20 / 1/8
(2025)			cord Master (120	ECTS) Mathematical Data Sc	ience - 2025	P~5~ J0 / 140



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

Module title					Abbreviation		
Stocha	Stochastical Processes 10-M=ASTP-161-m01						
Module	e coord	inator		Module offered by			
Dean of Studies Mathematik (Mathemati		natics)	Institute of Mathematics				
ECTS Method of grading Only after succ. compl. of module(s)							
10 numerical grade							
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	its						
Markov	/ chains	s, queues, stochastic p	rocesses in C[0,1], Brow	wnian motion, Donsk	er's theorem, projec	ctive limits.	
Recom Basic k the cor	mendeo (nowleo ntents o	d previous knowledge: lge of stochastics is rea ff the module "Stochas	quired, such as that ac tics 2" is also recomme	quired in the "Stocha ended.	astics 1" module. Kn	owledge of	
Intend	ed learr	ning outcomes					
The stu them to	ident is o practi	acquainted with the fu cal problems.	ndamental notions an	d methods of stocha	stical processes and	d can apply	
Course	S (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)			
V (4) + Module	Ü (2) e taugh	t in: German and/or En	glish				
Metho module is	d of ass s creditab	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) writt 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 						
credita	ble for	bonus					
Allocat	ion of p	olaces					
Additio	onal info	ormation					
Worklo	ad						
300 h							
Teachi	ng cycl	e					
		-					
Referre	ed to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)			
Module appears in							
Master's degree (1 major) Mathematics (2016)							
Master	Master's degree (1 major) Economathematics (2016)						
Master	's degre	ee (1 major) Mathemati	cal Physics (2016)				
Master	's degre	ee (1 major) Computati	onal Mathematics (201	6)			
Master	's teacł	ning degree Gymnasiun	n MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)	
Supple	ementar	y course MINT Teacher	Education PLUS, Elite	Network Bavaria (ENI	B) (2016)		
Master	's degre	ee (1 major) Computatio	onal Mathematics (201	9)			
Master	's degre	ee (1 major) Mathemati	cs (2019)				
Master's w (2025)	ith 1 major	Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sci	. reg. data re- ence - 2025	page 32 / 148	

UNIVERSITÄT WÜRZBURG

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)

Module title					Abbreviation		
Time S	Time Series Analysis 10-M=AZRA-212-m01						
Module	e coord	inator		Module offered by			
Dean of Studies Mathematik (Mathema			natics)	Institute of Mathematics			
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		•				
Additiv	e mode	el, linear filters, autocor	relation, moving avera	ge, autoregressive p	rocesses, Box-Jenkiı	ns method.	
Recom Basic k the cor	mende nowlea ntents a	d previous knowledge: lge of stochastics is req of the module "Stochast	uired, such as that ac ics 2" is also recomme	quired in the "Stocha ended.	astics 1" module. Kn	owledge of	
Intende	ed lear	ning outcomes					
The stu probler	ident is ms.	acquainted with the fu	ndamental methods o	f time series analysis	s and can apply then	n to practical	
Course	S (type, r	number of weekly contact hours	, language — if other than Ge	rman)			
V (4) + Module	Ü (2) e taugh	t in: German and/or Eng	glish				
Metho module is	d of ass s creditab	sessment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
a) writt b) oral c) oral Langua Assess	en exa examir examin ige of a ment o	mination (approx. 90 to nation of one candidate nation in groups (groups ssessment: German or ffered: in the semester	120 minutes, usually each (approx. 20 minu of 2, 15 minutes per c English in which the course is	chosen) or utes) or andidate) offered and in the su	ıbsequent semester		
Allocat	ion of						
Allocal		JIdles					
			_				
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	immes)			
Module appears in							
Master	's degr	ee (1 major) Economath	ematics (2021)				
Master's degree (1 major) Computational Mathematics (2022)							
Master	's degr	ee (1 major) Mathemati	cs (2022)				
Master	's degr	ee (1 major) Mathematio	cal Physics (2022)				
Master	's degr	ee (1 major) Economath	ematics (2022)				
exchan	ige pro	gram Mathematics (202	3)				
Master	Master's degree (1 major) Computational Mathematics (2024)						
Master	's degr	ee (1 major) Mathematio	cs (2024)				
Master's w (2025)	ith 1 majo	r Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	i. reg. data re- ience - 2025	page 34 / 148	



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

Module title					Abbreviation	
Mathe	Mathematical Statistics 10-M=VSTA-212-m01					
Module	e coord	inator		Module offered by		
Dean of Studies Mathematik (Mathemat		natics)	Institute of Mathem	atics		
ECTS	CTS Method of grading Only after succ. compl. of module(s)					
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts		•			
Conting crimina Recom Basic k the cor	gency ta ant func mendeo nowlec	ables, categorical regre tion analysis, cluster a d previous knowledge: lge of stochastics is req f the module "Stochast	ssion, one-factorial va nalysis, principal comp uired, such as that acc ics 2" is also recomme	riance analysis, two- oonent analysis, fact quired in the "Stocha	factorial variance an or analysis. astics 1" module. Kno	alysis, dis- owledge of
Intend	ed learn	ning outcomes				
The stu proble	ident is ms.	acquainted with the fu	ndamental methods ir	statistical analysis	and can apply them	to practical
Course	S (type, n	umber of weekly contact hours	, language — if other than Ger	man)		
V (4) + Module	Ü (2) e taugh	t in: German and/or Eng	glish			
Metho module is	d of ass s creditab	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
a) writt b) oral c) oral Langua Assess credita	en exar examin examin ige of a ment o ble for	nination (approx. 90 to ation of one candidate ation in groups (groups ssessment: German or ffered: In the semester bonus	120 minutes, usually o each (approx. 20 minu of 2, 15 minutes per c English in which the course is	chosen) or utes) or andidate) offered and in the su	ibsequent semester	
Allocat	ion of p	olaces				
Additio	onal info	ormation				
Worklo	ad					
300 h						
Teachi	ng cvcl	2				
	<u> </u>	-				
Referre	d to in	IPOI (examination regulation	ns for teaching-degree progra	mmes)		
Module appears in						
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 w (2025)	iin 1 major	mathematical Data Science	JMU Würzburg • ge cord Master (120	ECTS) Mathematical Data Sci	. reg. data re- ience - 2025	page 36 / 148
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)

Module	Module title Abbreviation					
Stocha	Stochastic Models of Risk Management 10-M=ASMR-161-m01				01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathen	natics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Contents						
Measur res, val la, moc estima series a risk in t	re theo lue at ri lelling tes of s analysi time se	ry, risk diagrams, failure sk, conditional value at of functional interrelatio hortfall measures, estir s, methods of exponent ries, elementary empiri	e mode and effects and risk, axiomatic of risk ons, regression models nates of value at risk a ial smoothing, predict cal regression analysis	alysis, risk assessme measures, modellin , basics in time serio nd conditional value ions and prediction , simulation method	ent in auditing, short g of interdependenc es modelling, aggreg e at risk, basics in en domains, estimates ls.	fall measu- ies, copu- gated losses, npirical time of value at
Intende	ed lear	ning outcomes				
The stu	dent is	acquainted with the fu	ndamental methods of	f stochastic risk anal	lysis.	
Course	S (type, r	number of weekly contact hours	, language — if other than Ger	man)		
V (4) + Module	Ü (2) e taugh	t in: German and/or Eng	glish			
Metho module is	d of ass s creditab	Sessment (type, scope, langu le for bonus)	age — if other than German, e	examination offered — if no	t every semester, informati	on on whether
b) oral c) oral Langua Assess	examir examin ige of a ment o	aation of one candidate ation in groups (groups ssessment: German or ffered: In the semester	each (approx. 20 minu of 2, 15 minutes per c English in which the course is	ites) or andidate) offered and in the su	ubsequent semester	
	ion of r					
Allocal		Jaces				
			_			
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e	_			
Referre	d to in	LPO I (examination regulation	ns for teaching-degree progra	mmes)		
 Moduli		ve in				
Mostor	appea	urs m 				
Master	's degr	ee (1 major) Mathematic	.5 (2016) ematics (2016)			
Master	's degr	ee (1 major) Mathematic	cal Physics (2016)			
Master	's degr	ee (1 major) Computatio	nal Mathematics (201	6)		
Master	's teacl	ning degree Gymnasium	MINT Teacher Educati	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)
Supple	mentai	y course MINT Teacher	Education PLUS. Elite I	Network Bavaria (EN	B) (2016)	- /
Master	's degr	ee (1 major) Computatio	onal Mathematics (201	9)		
Master	's degr	ee (1 major) Mathemati	cs (2019)	-		
Master's w (2025)	ith 1 majo	r Mathematical Data Science	JMU Würzburg • ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	n. reg. data re- ience - 2025	page 38 / 148

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)

Nomerical and Applied Mathematics 10-M=VNAM-192-mo1 Module cordinator Module offered by Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade Duration Module level Other prerequisites 1 semester graduate Contents In-depth discussion of a specialised topic in numerical or applied mathematics taking into account recent developments and interrelations with other mathematical concepts. Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of applied mathematics is required. In case of doubt, it is recommended to consult the lecturer. Intended Learning outcomes The student is acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems.			
Module coordinator Module offered by Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method f grading Only after succ. compl. of module(s) 10 numerical grade Duration Module level Other prerequisites 1 semester graduate Contents In-depth discussion of a specialised topic in numerical or applied mathematics taking into account recent developments and interrelations with other mathematical concepts. Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of applied mathematics is required. In case of doubt, it is recommended to consult the lecturer. Intended learning outcomes The student is acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems. Second topic in numerical or applied mathematics, and is able to apply these to complex problems.			
Dean of Studies Mathematik (Mathematics)Institute of MathematicsECTSMethematik (Mathematics)Institute of Mathematics10numerical gradeDurationModule levelOther prerequisites1 semestergraduateContentsIn-depth discussion of a specialised topic in numerical or applied mathematics taking into account recent developments and interrelations with other mathematical concepts.Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of applied mathematics is required. In case of doubt, it is recommended to consult the lecturer.Intended learning outcomesInterrelation acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems.			
ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade Duration Module level Other prerequisites 1 semester graduate Contents In-depth discussion of a specialised topic in numerical or applied mathematics taking into account recent developments and interrelations with other mathematical concepts. Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of applied mathematics is required. In case of doubt, it is recommended to consult the lecturer. Intended learning outcomes The student is acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems.			
10 numerical grade Durati→ Module level Other prerequisites 1 semester graduate Contents In-depth discussion of a specialised topic in numerical or applied mathematics taking into account recent developments and interrelations with other mathematical concepts. Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of applied mathematics is required. In case of doubt, it is recommended to consult the lecturer. Intended learning outcomes The student is acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems.			
DurationModule levelOther prerequisites1 semestergraduateContentsIn-depth discussion of a specialised topic in numerical or applied mathematics taking into account recent developments and interrelations with other mathematical concepts.Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of applied mathematics is required. In case of doubt, it is recommended to consult the lecturer.Intended learning outcomesThe student is acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems.Courses for applied mathematics and advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems.			
1 semester graduate Contents In-depth discussion of a specialised topic in numerical or applied mathematics taking into account recent developments and interrelations with other mathematical concepts. Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of applied mathematics is required. In case of doubt, it is recommended to consult the lecturer. Intended learning outcomes The student is acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems.			
Contents In-depth discussion of a specialised topic in numerical or applied mathematics taking into account recent deve- lopments and interrelations with other mathematical concepts. Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of applied mathematics is requi- red. In case of doubt, it is recommended to consult the lecturer. Intended learning outcomes The student is acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems. Courses (numerical or applied mathematics)			
In-depth discussion of a specialised topic in numerical or applied mathematics taking into account recent deve- lopments and interrelations with other mathematical concepts. Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of applied mathematics is requi- red. In case of doubt, it is recommended to consult the lecturer. Intended learning outcomes The student is acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems.			
Intended learning outcomes The student is acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems. Courses (a provide the set of			
The student is acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems.			
CULISES (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 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			
Teaching cycle			
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) Economathematics (2021)			
Master's with 1 major Mathematical Data Science JMU Würzburg • generated 14-Dez-2024 • exam. reg. data re- page 40 / 148			

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 with 1 major Mathematical Data Science (2025)





Subfield Mathematics

(ECTS credits)

Module	Module title Abbreviation					
Differe	ntial Ge	eometry			10-M=ADGM-161-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	npl. of module(s)		
10	nume	rical grade				
Duratio	Duration Module level Other prerequisites					
1 seme	ster	graduate				
Conten	ts					
Central folds. Recom Basic k metric	Central and advanced results in differential geometry, in particular about differentiable and Riemannian mani- folds. Recommended previous knowledge: Basic knowledge from the modules "Introduction to Differential Geometry", "Introduction to Topology" and "Geo-					
Intend	ed lear	ning outcomes				
The stu able to try.	dent is apply f	acquainted with conce hese methods and kno	epts and methods for d ows about the interaction	ifferentiable manifol on of local and globa	ds or Riemannian m l methods in differe	anifolds, is ntial geome-
Course	S (type, r	umber of weekly contact hour	s, language — if other than Gei	rman)		
V (4) + Module	Ü (2) e taugh	t in: German and/or En	glish			
Metho module is	d of ass creditab	sessment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) writt b) oral c) oral Langua Assess credita	 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 					
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	mmes)		
Module	e appea	ars in				
Master Master Master Master Supple	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 W (2025)	iun i majoi	mathematical Data Science	cord Master (120	ECTS) Mathematical Data Sci	ence - 2025	page 43 / 148

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)

Module	Module title Abbreviation					
Lie The	Lie Theory 10-M=ALTH-161-m01				1	
Module	e 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	Duration Module level Other prerequisites					
1 seme	1 semester graduate					
Conten	ts					
Linear L exampl Recomr Basic k mendeo useful.	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 leari	ning outcomes				
The stu apply th ar algeb	dent is hese to ora.	acquainted with the fu common problems, an	ndamental results, the d knows about the inte	eorems and methods eractions of group th	in Lie theory. He/Sh eory, analysis, topol	ie is able to ogy and line-
Course	S (type, n	umber of weekly contact hours	, language — if other than Ger	man)		
V (4) + I Module	Ü (2) e taugh	t in: German and/or Enន្	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
module is	creditab	le for bonus)	_			
a) writte b) oral e c) oral e Langua Assessi credital	en exar examin examin ge of a ment o ble for	nination (approx. 90 to ation of one candidate ation in groups (groups ssessment: German or I ffered: In the semester bonus	120 minutes, usually each (approx. 20 minu of 2, 15 minutes per c English in which the course is	chosen) or utes) or andidate) offered and in the su	bsequent 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	mmes)		
Module	e appea	irs in				
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) Master's with 1 major Mathematical Data Science JMU Würzburg • generated 14-Dez-2024 • exam. reg. data re- page 45 / 148						
(2025)			Coru Master (120	LCTS) mathematical Data Sci	ence - 2025	

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)

Module	Module title Abbreviation					
Mathematical Control Theory 10-M=ARTH-242-mo1					10-M=ARTH-242-m01	
Module	coord	inator		Module offered by		
Dean of Studies Mathematik (Mathematics) Institute of Mat			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 semes	ster	graduate				
Content	ts					
Introdu bility, b Recomr	ction to asics i nendeo	o mathematical systems t n optimal control. d previous knowledge:	theory: stability, cont	rollability and obser	vability, state feedback and sta-	
Basic k	nowlec	lge of the contents of the	module "Ordinary Di	fferential Equations	" is useful.	
Intende	d learr	ning outcomes				
The stu blish a and oth	dent is connec er fielc	acquainted with the func- ction between these resu Is of mathematics.	damental notions and Its and broader theor	d methods of control ies, and learns abou	theory. He/She is able to esta- the interactions of geometry	
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (4) + ĺ Module	ت (2) taugh	t in: German and/or Engli	ish			
Method module is	l of ass creditab	s essment (type, scope, langua ₎ le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writte b) oral e c) oral e Langua Assessi	en exar 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 Er ffered: In the semester in	20 minutes, usually c ach (approx. 20 minu of 2, 15 minutes per ca nglish which the course is o	thosen) or tes) or andidate) offered and in the su	ıbsequent semester	
	ion of r					
Additio	nal info	ormation				
Worklo	ad					
300 h						
Teachin	ig cycl	e				
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)		
Module	appea	irs in				
Master' Master' Master' Master' Suppler	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)					

Module	Module title Abbreviation					
Comple	ex Analy	ysis			10-M=AFTH-161-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studie	es Mathematik (Mather	natics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	numei	rical grade				
Duratio	Duration Module level Other prerequisites					
1 seme	1 semester graduate					
Conten	ts					
In-dept geome ons (e. Recom Basic k	In-depth study of mapping properties of analytic functions and their generalisations with modern analytic and geometric methods. Structural properties of families of holomorphic and meromorphic functions. Special functi- ons (e. g. elliptic functions). Recommended previous knowledge: Basic knowledge of the contents of the module "Introduction to Complex Analysis" is recommended					
Intende	ed learr	ning outcomes				
The stu ticular betwee	dent is the (geo n his/h	acquainted with the fu ometric) mapping prop ner acquired skills and o	ndamental notions, m erties of holomorphic f other branches of math	ethods and results o functions. He/She is nematics and applica	f higher complex and able to establish a c ations in other subje	alysis, in par- onnection cts.
Course	S (type, n	umber of weekly contact hours	, language — if other than Ger	man)		
V (4) + Module	Ü (2) e taugh	t in: German and/or En	glish			
Method module is	d of ass creditab	le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether
a) writt b) oral c) oral Langua Assess credita	en exar examin examin ge of a ment o ble for	nination (approx. 90 to ation of one candidate ation in groups (groups ssessment: German or ffered: In the semester bonus	each (approx. 20 minutes, usually of each (approx. 20 minutes of 2, 15 minutes per c English in which the course is	cnosen) or utes) or andidate) offered and in the su	ibsequent semester	
Allocat	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
300 h						
Teachi	ng cycle	e				
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)		
Module	e appea	irs 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)						
(2025)			cord Master (120	ECTS) Mathematical Data Sci	ence - 2025	,

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)

Module title Abbreviation						
Insurar	ice Ma	thematics 1			10-M=AVSM-161-m	01
Module	e coord	inator		Module offered by		
Dean of	fStudie	es Mathematik (Mather	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	1 semester graduate					
Conten	Contents					
The mo types o policy v Recom Depend quired.	The module discusses policies on one life: distributions of future lifetime, life tables, life table approximations, types of benefits, present value, expection principle, premium calculation, commutation functions, reserves and policy values, expenses, bonus, recursive methods, Thiele's differential equation. Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of statistics or stochastics is re-					
Intende	ed lear	ning outcomes				
The stu ply the	dent is m to pr	acquainted with the fu actical problems.	ndamental notions an	d methods of life ins	urance mathematics	and can ap-
Course	S (type, n	umber of weekly contact hour	s, language — if other than Ger	man)		
V (4) + Module	Ü (2) e taugh	t in: German and/or En	glish			
Method module is a) writte	d of ass creditab en exar	eessment (type, scope, lang le for bonus) nination (approx. 90 to	uage — if other than German, (examination offered — if no 	t every semester, informati	on on whether
b) oral c) oral c Langua Assess credita	examin examin ge of a ment o ble for	ation of one candidate ation in groups (groups ssessment: German or ffered: In the semester bonus	each (approx. 20 minus of 2, 15 minutes per c English in which the course is	utes) or andidate) offered and in the su	ibsequent semester	
Allocat	ion of r	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	's degr	ee (1 major) Mathemati	cs (2016)			
Master	's degr	ee (1 major) Economath	iematics (2016)			
Master'	's degr	ee (1 major) Computatio	onal Mathematics (201			
Master'	s teach	ning degree Gymnasiun	Education DLUS Elite	ION PLUS, Elite Netwo	эгк Bavaria (ENB) (20 8) (2016)	J16)
Supple Master	niental 's deor	y course mini reacher ee (1 maior) Computatio	nal Mathematics (201	o)	(010)	
Master's wi	th 1 major	Mathematical Data Science	JMU Würzburg • ge	>> enerated 14-Dez-2024 • exam	. reg. data re-	page 50 / 148
(2025)	.,.		cord Master (120	ECTS) Mathematical Data Sc	ience - 2025	

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) Economathematics (2021)

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

Master's degree (1 major) Mathematics (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)

Module title					Abbreviation		
Giovan	ni Prod	i Lecture (Master)			10-M=AGPCin-152-r	n01	
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mathe	matics)	Institute of Mathem	nstitute of Mathematics		
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)			
5 numerical grade							
Duration Module level Other prerequisites							
1 seme	stor	graduate					
Conton		Sidudite					
Introdu	iction t	a specialized topic in	mathomatics by an int	ornational oxport			
Intond				emational expert.			
The	ed lear	ing outcomes					
themat themat	tics. He tics and	She is able to establist Applications in other	sh a connection betwee subjects.	nd methods of a cor n his/her acquired s	skills and other brand	ches of ma-	
Course	S (type, r	umber of weekly contact hour	rs, language — if other than Gei	man)			
V (3) +	Ü (1)						
Module	e taugh	t in: English	<u> </u>				
Metho module in	d of ass s creditab	essment (type, scope, lang	guage — if other than German,	examination offered — if no	t every semester, informati	ion on whether	
Langua Assess credita	age of a ment o ble for	ssessment: English ffered: In the semester bonus	r in which the course is	offered and in the su	ubsequent semester		
Allocat	ion of _l	olaces					
Additio	onal inf	ormation					
Worklo	ad						
150 h							
Teachi	ng cycl	e					
Referre	ed to in	LPO I (examination regulation	ions for teaching-degree progra	mmes)			
	_						
Module	e appea	ars in					
Master	's degr	ee (1 major) Mathemat	ics International (2015)				
Master	's degr	ee (1 major) Mathemat	ics (2016)				
Master	Master's degree (1 major) Mathematical Physics (2016)						
Master	Master's degree (1 major) Computational Mathematics (2016)						
Master	's degr	ee (1 major) Computati	onal Mathematics (201	9)			
Master	's degr	ee (1 major) Mathemat	ICS (2019)				
Master	's degr	ee (1 major) Mathemat	ical Physics (2020)				
Master	s uegr 's dear	ee (1 major) Mathemat	onal Mathematics (2021)	2)			
Master	's degr	ee (1 major) Mathemat	ics (2022)	<i>_</i>)			
		, , , <u>, , , , , , , , , , , , , , , , </u>					
Master's w (2025)	ith 1 majo	Mathematical Data Science	JMU Würzburg • ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	n. reg. data re- ience - 2025	page 52 / 148	



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)

Module	Module title Abbreviation					
Selecte	Selected Topics in Analysis 10-M=VANA-161-m01)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	ıpl. of module(s)		
10	nume	rical grade				
Duratio	Ouration Module level Other prerequisites					
1 seme	1 semester graduate					
Conten	ts					
In-dept with ot Recom Depend doubt,	In-depth discussion of a specialised topic in analysis taking into account recent developments and interrelations with other mathematical concepts. Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of analysis is required. In case of					
Intend	ed lear	ning outcomes				
The stu comple	ident is ex prob	acquainted with advan lems.	ced results in a select	ed topic in analysis,	and is able to apply	these to
Course	S (type, r	umber of weekly contact hours,	language — if other than Gei	rman)		
V (4) + Module	Ü (2) e taugh	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
module is	s creditab	le for bonus)				
a) writt b) oral c) oral Langua Assess credita	 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 					
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Workla	ad					
300 h						
Teachi	ng cycl	e				
	,					
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
Module	e appea	ars in				
Master	's degr	ee (1 maior) Mathematic	s (2016)			
Master	's degr	ee (1 major) Mathematic	al Physics (2016)			
Master	's degr	ee (1 major) Computatio	nal Mathematics (201	6)		
Master	's teacl	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)
Supple	mentai	y course MINT Teacher I	Education PLUS, Elite	Network Bavaria (ENE	B) (2016)	
Master	's degr	ee (1 major) Computatio	nal Mathematics (201	9)		
Master	's degr	ee (1 major) Mathematic	(2019)	neveted as Deces		
waster's w (2025)	itn 1 majoi	mathematical Data Science	cord Master (120	ECTS) Mathematical Data Sci	ence - 2025	page 54 / 148

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)

Module	Module title Abbreviation						
Selecte	Selected Topics in Financial Mathematics 10-M=VFNM-161-m01					01	
Module	e coord	inator		Module offered by			
Dean of	fStudie	es Mathematik (Mathe	natics)	Institute of Mathem	natics		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
10	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 seme	ster	 graduate					
Conten	ts	3	1				
Selecte of asse stochas Recom Familia 1" is str	ed topic t pricin stic inte mendee rity wit rongly r	s in financial mathema g in discrete time for fi egration, stochastic dif d previous knowledge: h the contents of the m ecommended.	ntics, e. g. conditional e nite spaces, American ferential equations and nodules "Introduction to	xpectation and mar out, Snell envelope, I Ito calculus, Black- O Stochastic Financia	tingales, fundamenta stopping time, optin Merton-Scholes mod al Mathematics" and	al theorem nal stopping, lel. "Stochastics	
Intende	ed leari	ning outcomes					
The stu contem	dent is porary	acquainted with adva research questions in	nced results in financia financial mathematics	l mathematics. He/S and can apply his/h	She gains the ability er skills to complex	to work on problems.	
Course	S (type, n	umber of weekly contact hour	s, language — if other than Ger	man)			
V (4) + Module	Ü (2) e taugh	t in: German and/or En	glish				
Methoo module is	d of ass creditab	e ssment (type, scope, lang le for bonus)	uage — if other than German, e	examination offered — if no	t every semester, informati	on on whether	
a) writte b) oral e c) oral e Langua Assess credita	en exar examin examin ge of a ment o ble for	nination (approx. 90 to ation of one candidate ation in groups (group ssessment: German or ffered: In the semester bonus	o 120 minutes, usually o each (approx. 20 minu s of 2, 15 minutes per c English in which the course is	chosen) or ites) or andidate) offered and in the su	ıbsequent semester		
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
300 h							
Teachir	ng cycl	٩					
	<u>15 cyce</u>	-					
Referre	d to in	IPOI (examination regulation	ons for teaching dogroe progra	mmec)			
				inities)			
Module	2002	rs in					
Module appears in Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016)							
Master'	's degr	ee (1 major) Computati	onal Mathematics (201	6)			
Master'	's teacl	ning degree Gymnasiur	n MINT Teacher Educati	on PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)	
Supple	mentar 's dear	y course MINT Teacher	EQUCATION PLUS, EIITE I	vetwork Bavaria (EN o)	в) (2016)		
Master's wi	th 1 major	Mathematical Data Science	JMU Würzburg • ge	77 enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sci	n. reg. data re-	page 56 / 148	

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) Economathematics (2021)

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

Master's degree (1 major) Mathematics (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)

Module	Module title Abbreviation						
Groups	Groups and their Representations 10-M=VGDS-161-m01						
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mathen	natics)	Institute of Mathem	atics		
ECTS	Meth	Method of grading Only after succ. compl. of module(s)					
10	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	1 semester graduate						
Conten	ts						
Finite p the S-ri Recom Basic k "Applie	ermuta ings of mende nowlea	ation groups and charad Schur. d previous knowledge: dge of algebra is assum bra".	ter theory of finite grou ed, such as can be acc	ups, interrelations ar quired in the module	nd special techniques such as s "Introduction to Algebra" and		
Intende	ed lear	ning outcomes					
The stu rary res blems.	ident m search	nasters advanced algeb questions in group theo	raic concepts and met ry and representation	hods. He/She gains t theory and can apply	the ability to work on contempo- y his/her skills to complex pro-		
Course	S (type, r	number of weekly contact hours	, language — if other than Ger	rman)			
V (4) + Module	Ü (2) e taugh	t in: German and/or Eng	glish				
Method module is	d of ass creditab	sessment (type, scope, lang ole for bonus)	uage — if other than German,	examination offered — if no	t every semester, information on whether		
a) writt b) oral c) oral Langua Assess credita	en exa examir examir ge of a ment o ble for	mination (approx. 90 to nation of one candidate nation in groups (groups ssessment: German or .ffered: In the semester bonus	120 minutes, usually each (approx. 20 minu of 2, 15 minutes per c English in which the course is	chosen) or utes) or andidate) offered and in the su	ibsequent semester		
Allocat	ion of _l	places					
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	ummes)			
Module	e appea	ars in					
Master	's degr	ee (1 major) Mathemati	cs (2016)				
Master	's degr	ee (1 major) Physics (20	16)				
Master	's degr	ee (1 major) Mathemati	cal Physics (2016)				
Master	's degr	ee (1 major) Computatio	onal Mathematics (201	6)			
Master	's teac	hing degree Gymnasium	n MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (2016)		
Supple	menta	ry course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2016)		
Master's wi (2025)	ith 1 majo	r Mathematical Data Science	JMU Würzburg • ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	. reg. data re- page 58 / 148 ience - 2025		

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)

Module	e title				Abbreviation	
Dynamical Systems 10-M=VDSY-161-m01					1	
Module	e coordi	nator		Module offered by		
Dean o	of Studie	s Mathematik (Mathem	natics)	Institute of Mathem	atics	
ECTS	Metho	d of grading	Only after succ. con	npl. of module(s)		
5	numer	ical grade				
Duratio	Iration Module level Other prerequisites					
1 seme	1 semester graduate					
Conten	its		•			
Fundan	nentals	of dynamical systems,	e.g. stability theory, e	ergodic theory, Hamil	tonian systems.	
Recom Basic k	mended nowled	l previous knowledge: ge of the contents of th	e module "Ordinary D	ifferential Equations'	' is useful.	
Intende	ed learn	ing outcomes				
The stu quality	ident m	asters the mathematica	Il methods in the theo	ry of dynamic system	is, and is able to ana	alyse their
Course	S (type n	umber of weekly contact hours	 Janguage — if other than Ger	rman)		
V (3) +	Ü (1) e taught	in: German and/or Eng	lish			
Method module is	d of ass s creditabl	essment (type, scope, langue of bonus)	age — if other than German,	examination offered — if no	t every semester, informatio	on on whether
b) oral c) oral Langua Assess credita	examinates examin	ation of one candidate ation in groups (groups ssessment: German or l fered: In the semester ponus	each (approx. 15 minu of 2, approx. 10 minu English n which the course is	ites) or tes per candidate) offered and in the su	ibsequent semester	
Allocat	ion of p	laces				
Additio	onal info	ormation				
Worklo	ad					
150 h						
Teachi	ng cycle	9				
Referre	ed to in l	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
Module	e appea	rs in				
Master	's degre	e (1 major) Mathematio	cs (2016)			
Master	's degre	e (1 major) Economath	ematics (2016)			
Master	's degre	ee (1 major) Mathematio	al Physics (2016)			
Master	's degre	ee (1 major) Computatio	nal Mathematics (201	6)		
Master	's teach	ing degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)
Supple	ementary	y course MINT Teacher	Education PLUS, Elite	Network Bavaria (ENI	B) (2016)	
Master	's degre	ee (1 major) Computatio	nal Mathematics (201	9)		
Master	's degre	e (1 major) Mathematio	s (2019)			,
Master	's teach	Ing degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20)20)
(2025)	minimajor	mathematical Data Science	cord Master (120	ECTS) Mathematical Data Sci	ence - 2025	µaze 00 / 148

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)

Module title Abbreviation					Abbreviation		
Mathematical Imaging 10-M=VMBV-161-m01							
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)				
5	nume	rical grade					
Duratio	Duration Module level Other prerequisites						
1 seme	ster	graduate					
Conten	ts						
Mather camera ra pictu Recom Basic k ded.	natical model ires; al mende nowlec	fundamentals of image Is and camera calibratio gorithms; module migh d previous knowledge: Ige of functional analys	e processing and comp on, rigid and non-rigid t also include an introc is, such as that taught	uter vision such as e registration, reconstr duction to geometric in the module "Func	lementary projective ruction of 3D objects methods and tomog tional Analysis", is r	e geometry, from came- graphy. ecommen-	
Intende	ed lear	ning outcomes					
The stu fields o	dent m f appli	asters the mathematic cation.	al methods in the theo	ry of image processi	ng and knows about	their main	
Course	S (type, r	umber of weekly contact hours	, language — if other than Ger	man)			
V (3) + Module	Ü (1) e taugh	t in: German and/or En	glish				
Method module is	d of ass creditab	s essment (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informatio	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 							
Allocation of places							
Additio	nal inf	ormation					
Worklo	ad						
150 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) 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)							
Iviasier 5 uegree (1 major) computational Mathematics (2019)							
(2025)	пттпајо	mainematical Data Science	cord Master (120	ECTS) Mathematical Data Sci	ence - 2025	page 02 / 148	

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)

Selected Topics in Mathematical Control Theory 10-M=VTRT-242-mo1 Module coordinator Module offered by Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade Duration Module level Other prerequisites 1 semester graduate Contents						
Module coordinator Module offered by Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade Duration Module level Other prerequisites 1 semester graduate Contents						
Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade Duration Module level Other prerequisites 1 semester graduate Contents Sector						
ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade Duration Module level Other prerequisites 1 semester graduate Contents Output in the second secon						
10 numerical grade Duration Module level Other prerequisites 1 semester graduate Contents						
Duration Module level Other prerequisites 1 semester graduate Contents						
1 semester graduate Contents						
Contents						
Selected topics in linear and non-linear control theory, e.g. networked linear control systems, controllability of bilinear systems. Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required.						
Intended learning outcomes						
The student gains insight into contemporary research problems in control theory. He/She masters advanced techniques in this field and can apply them to complex problems.						
Courses (type, number of weekly contact hours, language — if other than German)						
V (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 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						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
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)						

Module title					Abbreviation		
Non-linear Analysis 10-M=VNAN-161-m01							
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)				
5	numerical grade						
Duratio	Duration Module level Other prerequisites						
1 seme	1 semester graduate						
Conten	ts						
Method	ds in no	nlinear analysis (e.g. to	pological methods, n	nonotony and variation	onal methods) with	applications.	
Recom We record red in t	mendeo ommen :he mod	d previous knowledge: d basic knowledge of fu lules "Introduction to Fu	nctional analysis and nctional Analysis" and	partial differential e d "Applied Analysis".	quations, such as ca	an be acqui-	
Intende	ed learr	ning outcomes		,			
The stu bility o	ıdent is n practi	acquainted with the concal problems.	ncepts of non-linear a	nalysis, can compare	e them and assess t	heir applica-	
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	rman)			
V (3) + Module	Ü (1) e taught	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	ion on whether	
module is	s 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							
Allocation of places							
Additional information							
Additional information							
worklo			_				
150 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) Economatinematics (2016) Master's degree (1 major) Mathematical Physics (2016)							
master's degree (1 major) (malifematical MySICS (2010) Master's degree (1 major) Computational Mathematics (2016)							
Master's teaching degree Gymnasium MINT Teacher Education PLUS Elite Network Rayaria (ENR) (2016)							
Supplementary course MINT Teacher Education PLUS. Flite Network Bayaria (FNB) (2016)							
Master's degree (1 major) Computational Mathematics (2010)							
Master's degree (1 major) Mathematics (2019)							
Master's w	ith 1 major	Mathematical Data Science	JMU Würzburg • ge	enerated 14-Dez-2024 • exam	. reg. data re-	page 65 / 148	
(2025)			cord Master (120	ECTS) Mathematical Data Sci	ence - 2025		

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)

Module title					Abbreviation		
Networked Systems 10-M=VVSY-161-m01							
Module coordinator Module offered by							
Dean of Studies Mathematik (Mathematics) Institute of Mathematics							
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
5	numerical grade						
Duratio	Duration Module level Other prerequisites						
1 seme	1 semester graduate						
Conten	Its						
Conten system Recom	nporary is); ana mende	topics in networked lir lysis of control-theoreti d previous knowledge:	ear and non-linear dyr cal aspects (controllat	namical systems (hor pility, accessibility, ef	mogenous and non- tc.).	homogenous	
Basic k	nowled	lge of the contents of th	e module "Ordinary D	ifferential Equations'	' is useful.		
Intend	ed learr	ning outcomes					
The stu on con	ıdent is tempor	acquainted with advar ary research questions	iced methods in the fig in networked systems	eld of networked syst	ems. He gains the a	bility to work	
Course	S (type, n	umber of weekly contact hours	, language — if other than Gei	rman)			
V (3) + Module	Ü (1) e taugh	t in: German and/or En	glish				
Metho module is	d of ass s creditab	e essment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
 b) oral examination (approx. 66 to 96 minutes, usually chosen) of 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	ion of r	places					
Additic	nalinf	ormation					
Additio	nat init						
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 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 (2010)							
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2010)							
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)							
Waster's with 1 major Mathematical Data Science JMU Würzburg • generated 14-Dez-2024 • exam. reg. data re- page 67 / 148							
(2025)			cord Master (120	ECTS) Mathematical Data Sci	ence - 2025		

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)

Module	Module title Abbreviation						
Partial Differential Equations of Mathematical Physics 10-M=VPDP-161-m01							
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathematics) Institute of Mathematics							
ECTS Method of grading Only after succ. compl. of module(s)							
10	10 numerical grade						
Duration Module level Other prerequisites							
1 seme	1 semester graduate						
Conten	ts						
Elliptic, exampl ons and Recom Basic k Equatio	, parab les; init d gener mende nowlec ons" is	olic, and hyperbolic equ ial and boundary value alisations; Hilbert spac d previous knowledge: lge from the modules "O recommended, as well a	ations; Laplace equat problems; well-posed e methods; Sobolev s Ordinary Differential Ec as basic knowledge of	ion, heat equation a and ill-posed proble paces and Fourier tra quations" and "Introc functional analysis.	nd wave equation as ems; solution metho ansforms. duction to Partial Diff	s standard ds; extensi- ferential	
Intende	ed learı	ning outcomes					
The stu equation betwee	ident is ons, as en his/ł	acquainted with funda well as standard examp her acquired skills and c	mental concepts and solutions in the second se	solution methods in t al physics. He/She is nematics and questio	the theory of partial a able to establish a c ons in physics.	differential connection	
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	rman)			
V (4) + Ü (2) Module taught in: German and/or English							
Methoo module is	d of ass s creditab	s essment (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. 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							
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) 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 with 1 major Mathematical Data Science JMU Würzburg • generated 14-Dez-2024 • exam. reg. data re- page 69 / 148							
(2025)			cord Master (120	ECIS) Mathematical Data Sc	ience - 2025		

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)

Module title Abbreviation							
Pseudo Riemannian and Riemannian Geometry 10-M=VPRG-161-m01							
Module coordinator Module offered by							
Dean of	fStudie	es Mathematik (Mather	natics)	itics) Institute of Mathematics			
ECTS Method of grading Only after succ. compl. of module(s)							
10	10 numerical grade						
Duratio	Duration Module level Other prerequisites						
1 semester graduate							
Conten	ts						
The mo nian an map, Ja Laplace theory. Recom Advanc Geome	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						
Intende	eory" is	also recommended.					
The student is acquainted with advanced topics in differential geometry on Riemannian and pseudo-Riemannian manifolds. He/She is able to establish a connection between his/her acquired skills and other branches of ma- thematics and questions in physics.							
Courses (type, number of weekly contact hours, language — if other than German)							
V (4) + U (2) Module taught in: German and /or English							
Method of accessment (was seen language. Eather than Company explication offered a light transmission of the second language and the second language.							
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							
Allocat	ion of p	olaces					
Additional information							
Workload							
300 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 wi (2025)	th 1 majoi	Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	n. reg. data re- ience - 2025	page 71 / 148	

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)
Module title Abbreviation						
Functio	onal Ana	alysis			10-M=AFAN-161-mo	1
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					
Banach and Hilbert spaces, bounded operators, principles of functional analysis, further contemporary topics in functional analysis and applications to other fields of mathematics. Recommended previous knowledge:						
Familia	rity wit	h the contents of the m	odule "Advanced Anal	ysis" is strongly reco	mmended.	
Intend	ed learr	ning outcomes				
The stu sis, an	ıdent is d is abl	acquainted with funda e to apply these skills to	mental concepts and r complex questions.	nethods in a contem	porary field of funct	ional analy-
Course	S (type, n	umber of weekly contact hours	, language — if other than Gei	rman)		
V (4) + Module	Ü (2) e taugh	t in: German and/or Enទ្	lish			
Metho module is	d of ass s creditab	e 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 credita	examin examin Ige of a ment o ble for	ation 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 in which the course is	utes) or andidate) offered and in the su	bsequent semester	
Allocat	ion of r	laces				
Additic	nal inf	ormation	_			
Auuitit						
workie	au					
300 n			_			
Teachi	ng cycl	9				
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
Module	e appea	rs in				
Master	's degre	ee (1 major) Mathematic	:s (2016)			
Master	Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Mathematical Physics (2016)					
Master	's degre	ee (1 major) Computatio	nal Mathematics (201	6)		
Master	's teacł	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)
Supple	mentar	y course MINT Teacher	Education PLUS, Elite	Network Bavaria (ENI	3) (2016)	
Master	's degre	ee (1 major) Computatio	nal Mathematics (201	9)		
Master	's degre	ee (1 major) Mathematio	cs (2019)			
Master	's teach	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	020)
Master's w (2025)	ith 1 major	Mathematical Data Science	JMU Würzburg • ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sci	. reg. data re- ence - 2025	page 73 / 148

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)

Module title Abbreviation						
Applied	Differ	ential Geometry			10-M=VADG-161-mc)1
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			
1 semes	ster	graduate				
Conten	ts					
The mo tial geo timisati Recomr Advanc Geomet	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					
"Pseud	o-Riem	annian and Riemanniar	Geometry" and "Lie T	heory" is also recom	mended.	
Intende	ed learr	ning outcomes				
The stu blish a sics.	dent is connec	acquainted with select tion between his/her a	ed advanced applicati cquired skills and oth	ons of differential ge er branches of mathe	eometry. He/She is a ematics and question	ble to esta- 1s in phy-
Courses	5 (type, n	umber of weekly contact hours	, language — if other than Gei	rman)		
V (4) + Í Module	Ü (2) taught	t in: German and/or Eng	lish			
Method module is	l of ass creditab	essment (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) writte b) oral e c) oral e Langua Assessi credital	en exar examin examin ge of a ment o ble for	nination (approx. 90 to ation of one candidate ation in groups (groups ssessment: German or I ffered: In the semester bonus	120 minutes, usually each (approx. 20 minu of 2, 15 minutes per c English n which the course is	chosen) or utes) or andidate) offered and in the su	ıbsequent semester	
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
300 h						
Teachir	ng cycl	9				
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
		· •		-		
Module	appea	rs in				
Master' Master' Master' Master'	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)					
Master's wi (2025)	th 1 major	Mathematical Data Science	JMU Würzburg • ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	i. reg. data re- ience - 2025	page 75 / 148

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)

UNIVERSITÄT

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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)

Module	Module title Abbrevi					
Giovan	ni Proc	li Lecture Selected Top	ics (Master)		10-M=VGPSin-152-r	n01
Module	e coord	inator		Module offered by	I	
Dean o	f Studi	es Mathematik (Mathe	matics)	Institute of Mathem	natics	
ECTS	Meth	od of grading	Only after succ. con	pl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts	5.44444				
Introdu	iction t	o a specialised topic in	mathematics by an int	ernational expert		
Intende	ed lear	ning outcomes				
The stu	idont is	acquainted with the fu	Indamental concepts a	nd methods of a cor	temporany research	tonic in ma-
themat themat	tics. He	/She is able to establis applications in other	sh a connection betwee subjects.	en his/her acquired s	skills and other brand	ches of ma-
Course	S (type, 1	number of weekly contact hour	s, language — if other than Gei	rman)		
V (4) +	Ü (2)					
Module	e taugh	t in: English				
Metho	d of as	sessment (type, scope, lang	guage — if other than German,	examination offered — if no	ot every semester, informati	ion on whether
module is	s creditat	ole for bonus)				
c) oral Langua Assess credita	examir age of a ment o ble for	ation in groups (group issessment: English iffered: In the semester bonus	s of 2, 15 minutes per c in which the course is	andidate) offered and in the su	ubsequent semester	
Allocat	ion of	places				
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulation	ons for teaching-degree progra	immes)		
Module	e appea	ars in				
Master	's degr	ee (1 major) Mathemat	ics International (2015)			
Master	's degr	ee (1 major) Mathemat	ics (2016)			
Master's degree (1 major) Mathematical Physics (2016)						
Master's degree (1 major) Computational Mathematics (2016)						
Master	Master's degree (1 major) Computational Mathematics (2019)					
Master	Master's degree (1 major) Mathematics (2019)					
Master	Master's degree (1 major) Mathematical Physics (2020)					
Master	's aegr	ee (1 major) watnemat	onal Mathematics (2021)	2)		
Master	's degr	ee (1 major) Computati	ics (2022)	<i>∠</i>)		
Master's w (2025)	ith 1 majo	r Mathematical Data Science	JMU Würzburg • ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	n. reg. data re- ience - 2025	page 77 / 148



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)

Module	title				Abbreviation
Selecte	d Topio	cs in Mathematical Logic			10-M=AAML-242-m01
Module	coord	inator		Module offered by	
				Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster				
Content	ts				
Recomr Familian have no the lect	nendeo rity wit ot atten urer.	d previous knowledge: h the contents of the moo ded this lecture are welc	dule "Introduction to ome to discuss the p	Mathematical Logic' rior knowledge requ	' is recommended. Students who ired for the current course with
Intende	d learr	ning outcomes			
Courses	5 (type, n	umber of weekly contact hours, la	anguage — if other than Ger	man)	
V (3) + Ü Module	لّ (1) taught	t in: German and/or Engli	ish		
Method module is	l of ass creditab	e essment (type, scope, languag le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writte b) oral e c) oral e Langua Assessi	en exar examin examin ge of a ment o ple for	nination (approx. 60 to 1 ation of one candidate e ation in groups (groups o ssessment: German and/ ffered: In the semester in bonus	20 minutes, usually of ach (approx. 15 minu of 2, approx. 10 minut or English which the course is	chosen) or tes) or ces per candidate) offered and in the su	ıbsequent semester
Allocati	ion of p	olaces			
Additio	nal info	ormation			
Workloa	ad				
150 h					
Teachin	ıg cycl	9			
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	rs in			
Master'	s degre	ee (1 major) Computation	al Mathematics (202	4)	
Master' Master' Suppler	s degre s teach mentar	ee (1 major) Mathematics ning degree Gymnasium I y course MINT Teacher Ec	(2024) MINT Teacher Educati ducation PLUS, Elite I	on PLUS, Elite Netwo Network Bavaria (EN	ork Bavaria (ENB) (2025) B) (2025)

Module	e title				Abbreviation
Harmor	nic Ana	lysis			10-M=AHAN-242-m01
Module	e coordi	inator		Module offered by	
				Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	numei	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster				
Conten	ts				
Intende	ed learr	ning outcomes			
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) +	Ü (2)				
Module	taugh	t in: German and/or Engl	ish		
Methoo module is	d of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writt	en exar	nination (approx. 60 to 1	20 minutes, usually o	hosen) or	
b) oral	examin	ation of one candidate e	ach (approx. 20 minu	ites) or	
c) oral e	examin	ation in groups (groups of season and season are season as the season are s	of 2, 15 minutes per ca for English	andidate)	
Assess	ment of	ffered: In the semester in	which the course is	offered and in the su	Ibsequent semester
credita	ble for	bonus			
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Worklo	ad				
300 h					
Teachir	ng cycl	e			
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	rs in			
Master	's degre	ee (1 major) Computation	al Mathematics (202	4)	
Master	's degre	ee (1 major) Mathematics	(2024)		
Master'	's teach	ning degree Gymnasium I	WINT Teacher Educati	on PLUS, Elite Netwo	ork Bavaria (ENB) (2025)
Supple	Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)				

Module	Module title Abbreviation					
Crypto	graphy	/Coding Theory			10-M=VKRY-192-mc)1
Module	e coord	inator		Module offered by		
Dean o	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	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						
Intend	ed lear	ning outcomes				
The stu is able and cry	ident is to clas vptogra	acquainted with funda sify these results within phy with other fields of	mental concepts, metl more general theories mathematics.	nods and results in c s and knows about th	oding theory and cry ne connections of co	/ptography, ding theory
Course	S (type, n	umber of weekly contact hours	, language — if other than Gei	rman)		
V (4) + Module	Ü (2) e taugh	t in: German and/or Eng	glish			
Metho module is	d of ass s creditab	eessment (type, scope, langule for bonus)	uage — if other than German, .	examination offered — if no	t every semester, informati	ion on whether
a) writt b) oral c) oral Langua Assess credita	en exar examin examin ige of a ment o <u>ble for</u>	nination (approx. 90 to ation of one candidate ation in groups (groups ssessment: German or ffered: In the semester bonus	each (approx. 20 minutes, usually each (approx. 20 minutes of 2, 15 minutes per c English in which the course is	cnosen) or utes) or andidate) offered and in the su	ibsequent semester	
Allocat	ion of p	olaces				
Additio	onal info	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulation	ons for teaching-degree progra	immes)		
Module appears in						
Master Master Master Supple Master Master	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)					
(2025)			cord Master (120	ECTS) Mathematical Data Sci	ence - 2025	

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					
Discret	e Math	ematics			10-M=VDIM-161-mc)1
Module	e coord	inator		Module offered by		
Dean o	f Studie	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	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts		•			
Advanced methods and results in a selected field of discrete mathematics (e.g. coding theory, cryptography, graph theory or combinatorics) Recommended previous knowledge:						
Basic k	nowled	lge of the contents of th	e module "Introductio	n to Discrete Mathen	natics" is required.	
Intende	ed learr	ning outcomes				
The stu	ident is	acquainted with advan	ced results in a select	ed topic in discrete n	nathematics.	
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	man)		
V (3) + Module	Ü (1) e taugh	t in: German and/or Eng	lish			
Method module is a) writt	d of ass creditab en exar	essment (type, scope, langu le for bonus) nination (approx. 60 to	age — if other than German, d 90 minutes, usually c	examination offered — if no hosen) or	t every semester, informati	on on whether
b) oral c) oral Langua	examin examin ige of a ment o	ation of one candidate ation in groups (groups ssessment: German or E ffered: In the semester i	each (approx. 15 minu of 2, approx. 10 minu inglish n which the course is	tes) or tes per candidate) offered and in the su	hsequent semester	
credita	ble for	bonus				
Allocat	ion of p	olaces				
Additio	onal info	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination regulation	ns for teaching-degree progra	mmes)		
Module	e appea	irs in				
Master	's degre	ee (1 major) Mathematic	s (2016)			
Master	's degre	ee (1 major) Physics (20	16)			
Master	's degre	ee (1 major) Nanostructu	re Technology (2016)			
Master	's degre	ee (1 major) Economathe	ematics (2016)			
Master	's degre	ee (1 major) Mathematic	al Physics (2016)			
Master	's teach	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)
Supple	mentar	y course MINT Teacher E	Education PLUS, Elite I	Network Bavaria (ENI	3) (2016)	
Master	's degre	ee (1 major) Mathematic	s (2019)			
Master's w	's degre	ee (1 major) Nanostructu	Inte Technology (2020)	enerated 14-Dez-2024 • exam	reg data re-	nage &2 / 1/8
(2025)	iti i majoi		cord Master (120	ECTS) Mathematical Data Sci	ence - 2025	page 03 / 140

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) 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)



Subfield Research in Groups and Seminars

(10 ECTS credits)

Module	Module title Abbreviation					
Resear	ch in G	roups - Inverse Probler	ns		10-M=GINP-222-mc	01
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathei	matics)	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					
Selecte	ed mod	ern topics in inverse pr	oblems.			
Recom After co se Prob vious s	mende onsulta olems 2 emeste	d previous knowledge: tion with the lecturer, p " is recommended. The er.	prior knowledge from th e reseaarch in groups u	ne modules "Inverse Isually builds on the	Problems 1" and pos content of a course f	sibly "Inver- rom the pre-
Intende	ed lear	ning outcomes				
The stu technic	ıdent g ques in	ains insight into conter this field and can appl	nporary research probl y them to complex prol	ems in inverse probl blems.	ems. He/She master	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			
Metho	d of ass	Sessment (type, scope, lang	guage — if other than German,	examination offered — if no	t every semester, informati	on on whether
module is	s creditab	le for bonus)				
talk (60	0 to 120) minutes) scossmont: Cormon or	English			
Assess	ment o	ffered: In the semester	in which the course is	offered and in the su	ıbsequent semester	
Allocat	ion of j	olaces			·	
Additio	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
	3 -)	-				
Referre	d to in	IPOI (examination regulation	ons for teaching-degree progra	ammes)		
Module	annea	ors in				
Master	's degr	ee (1 maior) Computati	onal Mathematics (202	2)		
Master	's degr	ee (1 major) Mathemati	ics (2022)	-2)		
Master's degree (1 major) Mathematical Physics (2022)						
Master	Master's degree (1 major) Economathematics (2022)					
exchan	ige pro	gram Mathematics (202	23) 			
Master	's degr	ee (1 major) Computati ee (1 major) Mathemati	unal mathematics (202	24)		
Master	's degr	ee (1 major) Economath	nematics (2024)			
Master	's teacl	ning degree Gymnasiur	n MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	025)
						· · · · · · · · · · · · · · · · · · ·
Master's w (2025)	ith 1 majo	r Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam • ECTS) Mathematical Data Sc	ı. reg. data re- ience - 2025	page 86 / 148



Module	Module title Abbreviation				
Resear	ch in G	roups - Mathematics of N	Machine Learning		10-M=GMAL-252-m01
Module	coord	nator		Module offered by	
				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				
Conten	ts				
Intende	ed learr	ning outcomes			
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) + S Module	S (2) taugh	t in: German and/or Engli	ish		
Methoo module is	l of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
talk (6c Langua Assessi	o to 120 ge of a ment o	minutes) ssessment: German or Er ffered: In the semester in	nglish which the course is	offered and in the su	ıbsequent semester
Allocat	ion of p	laces			
Additio	nal info	ormation			
Worklo	ad				
300 h					
Teachir	ng cycle	2			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	rs in			
keinem	Studie	ngang zugeordnet			

Module title Abbreviation				Abbreviation	
Semina	ar in Ma	athematics of Machine Le	earning		10-M=SMAL-252-m01
Module	e coord	inator		Module offered by	
				Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster				
Conten	ts				
Intende	ed leari	ning outcomes			
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
S (2) Module	e taugh	t in: German and/or Engl	ish		
Methoo module is	d of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
talk (60 Langua Assess	o to 120 ge of a ment o) minutes) ssessment: German and, ffered: In the semester in	/or English 1 which the course is	offered and in the su	ibsequent 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 regulations	s for teaching-degree progra	mmes)	
Module	e appea	irs in			
keinem	Studie	engang zugeordnet			

Module	e title				Abbreviation
Semina	ar in Inv	verse Problems			10-M=SINP-252-m01
Module	e coord	inator		Module offered by	
	_			Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster				
Conten	ts				
Intende	ed learn	ning outcomes			
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
S (2) Module	e taugh	t in: German and/or Engl	ish		
Methoo module is	d of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
talk (60 Langua Assess	o to 120 ge of a ment o) minutes) ssessment: German and, ffered: In the semester ir	/or English which the course is	offered and in the su	ıbsequent semester
Allocat	ion of p	olaces			
Additio	nal info	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	irs in			
keinem	Studie	engang zugeordnet			

Module title Abbreviation						
Resear	rch in G	roups - Numerical Mat	hematics and Applied A	Analysis	10-M=GNMA-161-m	101
Modul	e coord	inator		Module offered by	I	
Dean c	of Studi	es Mathematik (Mathe	matics)	Institute of Mathematics		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade		• • • •		
Duratio	on	Module level	Other prerequisites			
1 seme	ester	graduate				
Conter	nts	0]			
Selecte	Selected topics in numerical mathematics, applied analysis or scientific computing.					
Recom Depen thema	mende ding on tics is re	d previous knowledge: the content, basic and equired. In case of dou	l advanced knowledge bt, it is recommended t	from different areas to consult the lecture	of analysis and/or n er.	umerical ma-
Intend	ed lear	ning outcomes				
The stu He/Sh	udent g e maste	ains insight into a cont ers advanced technique	emporary research prol es in this field and can	blems in numerical r apply them to comp	nathematics or appl lex problems.	ied analysis.
Course	S (type, r	number of weekly contact hour	s, language — if other than Gei	rman)		
V (2) +	S (2)					
Modul	e taugh	t in: German and/or En	glish			
Metho module i	d of ass s creditab	sessment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
talk (6	o to 120	o minutes)				
Langua	age of a	ssessment: German or	English	offered and in the c	heer went competer	
Alleget				onered and in the si	ubsequent semester	
Alloca		Diaces				
Additio	onal Inf	ormation				
WORKIG						
300 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	immes)		
Modul	e appea	ars in				
Master	's degr	ee (1 major) Mathemati	ICS (2016)			
Master	Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016)					
Master	Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016)					
Master	Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)					
Supple	ementai	ry course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2016)	
Master	's degr	ee (1 major) Computati	onal Mathematics (201	9)		
Master	's degr	ee (1 major) Mathemati	cs (2019))
Master Supple	rs teacl ementai	ning degree Gymnasiur ry course MINT Teacher	n MINT Teacher Educat Education PLUS, Elite	ion PLUS, Elite Netw Network Bavaria (EN	огк Bavaria (ENB) (2 В) (2020)	020)
Master's w (2025)	ith 1 majo	r Mathematical Data Science	JMU Würzburg • go cord Master (120	enerated 14-Dez-2024 • exan	n. reg. data re- ience - 2025	page 91 / 148

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)

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 (Mathem	atics)	ics) Institute of Mathematics		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
	nume	rical grade				
Duratio	n	Module level	Other proroquisitos			
Duratio						
1 seme	ster	graduate				
Conten	ts					
A mode	ern topi	c in the research expert	ise of the current hold	er of the Giovanni Pr	odi Chair.	
Intende	ed lear	ning outcomes				
The stu	dent is	able to elaborate a con	temporary research to	pic. This includes co	mprehending and st	tructuring of
the top	ic and	the available literature,	preparing a talk and th	he ability to participa	ate in a scientific dis	cussion.
Course	S (type, r	number of weekly contact hours,	language — if other than Ger	rman)		
S(2)						
Module	e taugh	t in: English				
Method	l of ass	sessment (type scope langu	age — if other than German	examination offered — if no	t every semester informati	on on whether
module is	creditab	le for bonus)			every semester, mornad	
talk (60) to 120	o minutes)				
Langua	ge of a	ssessment: English				
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				
Additio		ormation				
Worklo	ad		-			
150 h						
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulation	ns for teaching-degree progra	mmes)		
		C				
Module	2000	ars in				
Mactor	- apped	ns m aa (4 maiar) Mathamatic	c International (2015)			
Master	's degr	ee (1 major) Mathematic	s international (2015)			
Master	's degr	ee (1 major) Mathematic	5 (2010) amatics (2016)			
Master	's door	ee (1 major) Leonomatic	al Physics (2010)			
Master	s uegi 's dogr	ee (1 major) Mathematic	al Filysics (2010) nal Mathomatics (201	6)		
Master	's dogr	ee (1 major) Computatio	nal Mathematics (201	0) 0)		
Master	's degr	ee (1 major) Computatio	s (2010)	9)		
Master's degree (1 Major) Mathematical Dhysics (2019)						
Master	Master's degree (1 major) Mathematics International (2020)					
Master	Master's degree (1 major) Mathematics (2021) Master's degree (1 major) Economathematics (2021)					
Master	Master's degree (1 major) Computational Mathematics (2021)					
Master	Master's degree (1 major) Computational Mathematics (2022)					
Master	's dear	ee (1 major) Mathematic	al Physics (2022)			
Master	's dear	ee (1 major) Mathematic	s International (2022)			
	Jucgi					
Master's wi (2025)	th 1 majo	r Mathematical Data Science	JMU Würzburg • ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	i. reg. data re- ience - 2025	page 93 / 148



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)

Modul	Module title				Abbreviation			
Semina	ar in Nu	merical Mathematics a	and Applied Analysis		10-M=SNMA-161-m	01		
Modul	e coord	inator		Module offered by				
Dean o	of Studi	es Mathematik (Mathe	matics)	ics) Institute of Mathematics				
ECTS	Meth	od of grading	Only after succ. con	Only after succ. compl. of module(s)				
	nume	rical grade						
Duratio	n		Other prerequisites					
	stor	graduato						
Contor		giduudle						
Amod			atics ar applied apply	10				
A mod	ern top	ic in numerical mathem	latics of applied analys	ols.				
Recom	mende	d previous knowledge:						
Depen	ding or	the content, basic and	l advanced knowledge	from different areas	of analysis and/or n	umerical ma-		
themat	tics is r	equired. In case of dou	bt, it is recommended	to consult the lecture	er.			
Intend	ed lear	ning outcomes						
The stu	udent is	able to elaborate a co	ntemporary research to	pic. This includes co	omprehending and s	tructuring of		
the top	oic and	the available literature	, preparing a talk and t	he ability to participa	ate in a scientific dis	cussion.		
Course	S (type, I	number of weekly contact hour	s, language — if other than Ge	rman)				
S (2)								
Modul	e taugh	t in: German and/or En	glish					
Metho	d of as	sessment (type, scope, lang	guage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether		
module i	s creditat	ole for bonus)						
talk (6	0 to 120	o minutes) Accessment: Cormon or	Englich					
Assess	ment c	iffered: In the semester	in which the course is	offered and in the su	ibsequent semester			
Allocat	tion of	places						
7 mocu								
Additid	nal inf	ormation						
Auulin								
WORKLO	ad							
150 h	_							
Teachi	ng cycl	e						
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	immes)				
Modul	e appea	ars in						
Master	's degr	ee (1 major) Mathemati	ics (2016)					
Master's degree (1 major) Economathematics (2016)								
Master's degree (1 major) Mathematical Physics (2016)								
Master	Master's degree (1 major) Computational Mathematics (2016)							
Master	Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Supple	Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Master	Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2010)							
Master	's teac	hing degree Gymnasiur	n MINT Teacher Educat	ion PLUS. Elite Netwo	ork Bavaria (ENB) (2	020)		
Supple	ementa	ry course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2020)	/		
Master's w (2025)	uth 1 majo	r Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam • ECTS) Mathematical Data Sc	1. reg. data re- ience - 2025	page 95 / 148		

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)

Module title					Abbreviation	
Semina	ar in Op	timization			10-M=SOPT-161-mc	01
Module	e coordi	nator		Module offered by		
Dean o	of Studie	es Mathematik (Mathe	matics)	Institute of Mathem	atics	
ECTS	Metho	d of grading	Only after succ. con	npl. of module(s)		
5	numer	ical grade		, ,,		
Duratio	on	Module level	Other prerequisites			
1 seme	otor	graduate				
Conton		graduate				
Conten						
A mode	ern topi	c in optimisation.				
Intend	ed learr	ing outcomes				
The stu the top	udent is bic and t	able to elaborate a co he available literature	ntemporary research to , preparing a talk and t	ppic. This includes co he ability to participa	omprehending and s ate in a scientific dis	tructuring of cussion.
Course	es (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
S (2)						
Module	e taught	in: German and/or Er	glish			
Metho	d of ass	essment (type, scope, lang	guage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
module is	s creditab	e for bonus)				
talk (60	0 to 120	minutes)				
Langua	age of a	ssessment: German or ffered: In the semester	English in which the course is	offered and in the su	ibsoquent comester	
Allocat	tion of p	laces			ibsequent semester	
Additio	onal info	ormation				
Worklo	ad					
150 h						
Teachi	ng cycle	2				
reaction	iis cycu	•				
Deferre				``````````````````````````````````````		
Referre		LPUT (examination regulat	ons for teaching-degree progra	immes)		
Module	e appea	rs in				
Master	r's degr€ √a degr€	e (1 major) Mathemat	ICS (2016)			
Master	r's degre degre	e (1 major) Economat	nematics (2016)			
Master	's degre	e (1 major) Mathemat	onal Mathematics (2010)	6)		
Master	's teach	ung degree Gymnasiu	n MINT Teacher Educat	ion PLUS, Elite Netw	ork Bavaria (FNB) (2	016)
Supple	ementar	v course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2016)	010)
Master	's degre	ee (1 major) Computati	onal Mathematics (201	9)	_, ()	
Master	r's degre	ee (1 major) Mathemat	ics (2019)			
Master	r's teach	iing degree Gymnasiu	n MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (2	020)
Supple	Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)					
Master	Master's degree (1 major) Mathematical Physics (2020)					
Master	r's degre	e (1 major) Economat	nematics (2021)	-)		
Master	s degre	e (1 major) Computati	onal Mathematics (202	2)		
Imaster	s uegre	e (1 major) Mathemat	165 (2022)			
Master's w (2025)	ith 1 major	Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	n. reg. data re- ience - 2025	page 97 / 148

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)

Module title					Abbreviation			
Seminar Applied Mathematics 10-N					10-M=SAMA-192-m	01		
Module	e coord	inator		Module offered by				
Dean o	f Studi	es Mathematik (Mather	natics)	tics) Institute of Mathematics				
ECTS	Meth	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	Siddate						
A mode	ern ton	ic in applied mathemat	 ics					
	in top							
Recom	mende	d previous knowledge:						
Depend	ding on	the content, basic and	advanced knowledge	from different areas	of applied mathema	itics is requi-		
rea. In	case of	doubt, it is recommen		urer.				
Intende	ed lear	ning outcomes						
The stu	ident is	able to elaborate a contra de la c	ntemporary research to preparing a talk and t	pic. This includes co be ability to particip:	omprehending and s	tructuring of		
Course								
Course	S (type, r	number of weekly contact hours	s, language — If other than Ge	rman)				
S (2) Module	• taugh	t in: German and/or En	glish					
Method	d of ase	essment (type scope lang	uage — if other than German	examination offered — if no	nt every semester informati	ion on whether		
module is	s creditat	le for bonus)	uuge in other than oerman,		it every semester, mormat	ion on whether		
talk (60	0 to 120	o minutes)						
Langua	ige of a	ssessment: German or	English					
Assess	ment o	ffered: in the semester	in which the course is	offered and in the su	ubsequent 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	ons for teaching-degree progra	ammes)				
Module appears in								
Master	's degr	ee (1 major) Computatio	onal Mathematics (201	9)				
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 degr	ee (1 major) Mathemati	cal Physics (2020)					
Master	's degr	ee (1 major) Economatł	iematics (2021)					
Master	's degr	ee (1 major) Computatio	onal Mathematics (202	22)				
Master	Master's degree (1 major) Mathematics (2022)							
Master	's degr	ee (1 major) Mathemati	cal Physics (2022)					
Master	's degr	ee (1 major) Economath	nematics (2022)					
Master's wi	ith 1 majo	r Mathematical Data Science	JMU Würzburg ● g	enerated 14-Dez-2024 • exam	n. reg. data re-	page 99 / 148		
(2025)			cord Master (120	ECTS) Mathematical Data Sc	ience - 2025			

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)

Module title				Abbreviation		
Research in Groups - Dynamical Systems and Control Theory 10-M=0					10-M=GDSC-242-m01	
Module	coord	inator		Module offered by		
Dean of	fStudie	es Mathematik (Mathema	tics)	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 semes	ster	graduate				
Conten	Contents					
Selecte Recomr Knowle	d mode nendee dge of	ern topics in dynamical s d previous knowledge: the contents of the modu	ystems and control th Ile "Mathematical Co	neory. ntrol Theory" or "Cor	ntrol Theory" is required.	
Intende	ed learr	ning outcomes				
The stu She ma	dent ga sters a	ains insight into contemp dvanced techniques in th	orary research problenis field and can app	ems in dynamical sys ly them to complex p	stems and control theory. He/ problems.	
Courses	5 (type, n	umber of weekly contact hours, la	anguage — if other than Ger	man)		
V (2) + 9 Module	S (2) taugh	t in: German and/or Engli	sh			
Method module is	l of ass creditab	essment (type, scope, languag le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk (60 Langua Assessi	to 120 ge of a ment o	minutes) ssessment: German or Er ffered: In the semester in	nglish which the course is	offered and in the su	ibsequent semester	
Allocati	ion of p	olaces				
	•					
Additio	nal info	ormation				
Worklo	ad					
300 h						
Teachir	ng cycle	9				
Referre	d to in	LPO I (examination regulations	for teaching-degree progra	mmes)		
Module	appea	rs in				
Master'	s degre	ee (1 major) Computation	al Mathematics (202	4)		
Master'	s degre	ee (1 major) Mathematics	(2024)			
Master'	s degre	ee (1 major) Economather	matics (2024)			
Master'	s teach mentar	ning degree Gymnasium I V course MINT Teachor Fr	WINT Teacher Education	ON PLUS, Elite Netwo Network Bayaria (ENI	DIK BAVARIA (ENB) (2025) B) (2025)	
Supple	mental	y course mint reacher EC	incation reus, eille i	verwork Davaria (EIVI	0) (2025)	

(2025)

Module	e title		Abbreviation					
Resear	ch in G	roups - Statistics		10-M=GSTA-161-mc)1			
Module	e coord	inator		Module offered by				
Dean o	f Studi	es Mathematik (Mathen	natics)	tics) Institute of Mathematics				
ECTS	Metho	od of grading	Only after succ. cor	Only after succ. compl. of module(s)				
10	nume	rical grade						
Duratio	n	Module level	Other prerequisites	;				
1 seme	ster	graduate						
Conten	ts							
Selecte	Selected modern topics in statistics.							
Recomi Basic k the con prior kr	mende nowled itents d nowled	d previous knowledge: dge of stochastics is req of the module "Stochast ge may also be helpful;	uired, such as that ac ics 2" is also recomme consultation with the	quired in the "Stocha ended. Depending or lecturer is recommer	astics 1" module. Kno I the content of the c Inded.	owledge of course, other		
Intende	ed lear	ning outcomes						
The stu ques in	dent g this fi	ains insight into contem eld and can apply them	porary research probl to complex problems.	ems in statistics. He,	/She masters advan	ced techni-		
Course	S (type, r	number of weekly contact hours	, language — if other than Ge	rman)				
V (2) + Module	S (2) e taugh	t in: German and/or Eng	glish					
Method	d of ass	sessment (type, scope, langu	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether		
module is	creditab	le for bonus)						
talk (60	o to 120	o minutes)						
Langua	ge of a ment o	ssessment: German or	English in which the course is	offered and in the su	ibsoquent comester			
Allocat	ion of I				ibsequent semester			
Additio	nal inf	ormation						
Worklo	ad							
200 h								
Teachi	ng cycl	e						
Referre	d to in	LPO I (examination regulation	ins for teaching-degree progra	ammes)				
Module appears in								
Master	's degr	ee (1 major) Mathematio	cs (2016)					
Master's degree (1 major) Economathematics (2016)								
Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gympacium MINT Toachor Education DLUS, Elite Network Payaria (ENP) (2016)								
Supple	mentai	ry course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2016)			
Master	Master's degree (1 major) Mathematics (2019)							
Master	's teacl	hing degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	020)		
Supple	mentai	ry course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2020)			
Master	s aegr	ee (1 major) Mathematic	cal Physics (2020)			I		
Master's wi (2025)	ith 1 majo	r Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam DECTS) Mathematical Data Sc	. reg. data re- ience - 2025	page 102 / 148		

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)

Module	Module title					Abbreviation		
Resear	Research in Groups - Non-linear Analysis					01		
Module	e coord	inator		Module offered by				
Dean o	f Studi	es Mathematik (Mathe	matics)	tics) Institute of Mathematics				
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)				
10	nume	rical grade		, ,,,				
Duratio	n	Module level	Other prerequisites					
1 seme	ster	graduate						
Conten	ts	3.44440						
Selecte	ed mod	ern topics in non-linea	r analysis.					
Recom Depend doubt,	mende ding on it is rec	d previous knowledge: the content, basic and commended to consult	l advanced knowledge the lecturer.	from different areas	of analysis is require	ed. In case of		
Intende	ed lear	ning outcomes						
The stu ced tec	dent g hnique	ains insight into conter es in this field and can	nporary research probl apply them to complex	ems in Non-linear Ar problems.	nalysis. He/She mas	ters 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					
Metho module is	d of ass s creditab	s essment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether		
talk (60	0 to 120	o minutes)						
Langua	ge of a	ssessment: German or	English					
Assess	ment o	ffered: In the semester	in which the course is	offered and in the su	ubsequent semester			
Allocat	ion of _l	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	ars in						
Master	's degr	ee (1 major) Mathemat	cs (2016)					
Master's degree (1 major) Mathematical Physics (2016)								
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)								
Master	Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2010)							
Master	's teacl	hing degree Gymnasiur	n MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (2	020)		
Supple	mentai	ry course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2020)			
Master	's degr	ee (1 major) Mathemat	cal Physics (2020)	、 、				
Master	's degr	ee (1 major) Computati	onal Mathematics (202	2)				
Imaster	s degr	ee (1 major) Mathemat	cs (2022)					
Master's w (2025)	ith 1 majo	r Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	n. reg. data re- ience - 2025	page 104 / 148		

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		
Semina	r in Dy	namical Systems and Co		10-M=SDSC-242-m01		
Module	coord	inator		Module offered by		
Dean of	fStudie	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Content	Contents					
A mode Recomr Knowle	ern topi mendeo dge of	c in dynamical systems a d previous knowledge: the contents of the modu	nd control. Ile "Mathematical Co	ntrol Theory" or "Cor	ntrol Theory" is required.	
Intende	d lear	ing outcomes		intervention of con	liter incory is required.	
The stu the topi	dent is ic and t	able to elaborate a conte the available literature, p	emporary research to reparing a talk and th	pic. This includes co ne ability to participa	mprehending and structuring of ate in a scientific discussion.	
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
S (2) Module	taugh	t in: German and/or Engli	ish			
Method module is	l of ass creditab	e ssment (type, scope, langua) le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk (60 Langua; Assessi	to 120 ge of a ment o	o minutes) ssessment: German or Er ffered: In the semester in	nglish which the course is	offered and in the su	ibsequent semester	
Allocati	ion of p	olaces			·	
Additio	nal info	ormation				
Worklo	ad					
150 h						
Teachin	ng cycle	9				
Referre	d to in	LPO I (examination regulations	for teaching-degree progra	mmes)		
Module	Module appears in					
Master'	s degre	ee (1 major) Computation	al Mathematics (202	4)		
Master's degree (1 major) Mathematics (2024)						
Master'	s degre	ee (1 major) Economathe	matics (2024)			
Master'	s teach	ning degree Gymnasium l	WINT Teacher Education	on PLUS, Elite Netwo	DIK BAVARIA (ENB) (2025)	
Supple	mental	y course mint reacher EC	aucation FLUS, Eille I	VELWOIN DAVAIIA (EIVI	5) (2025)	

(2025)

Module	Module title				Abbreviation		
Semina	ar in Sta	atistics			10-M=SSTA-161-mo	1	
Module	e coord	inator		Module offered by			
Dean o	f Studie	es Mathematik (Mathen	natics)	ics) Institute of Mathematics			
ECTS	Metho	od of grading	Only after succ. con	cc. compl. of module(s)			
5	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
A mode	A modern topic in statistics.						
Recomi Basic k the con prior kr	mende nowlec itents c nowled	d previous knowledge: lge of stochastics is req If the module "Stochast ge may also be helpful;	uired, such as that ac ics 2" is also recomme consultation with the	quired in the "Stocha ended. Depending or lecturer is recommer	nstics 1" module. Kno I the content of the c Inded.	owledge of course, other	
Intende	ed learı	ning outcomes					
The stu the top	dent is ic and	able to elaborate a cor the available literature,	ntemporary research to preparing a talk and t	ppic. This includes co he ability to participa	mprehending and state in a scientific dis	tructuring of cussion.	
Course	S (type, n	umber of weekly contact hours	, language — if other than Ge	rman)			
S (2) Module	e taugh	t in: German and/or Eng	glish				
Method	d of ass	essment (type, scope, langu	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
module is	creditab	le for bonus)					
talk (6c Langua	o to 120 ge of a	o minutes) ssessment: German or	English				
Assess	ment o	ffered: In the semester	in which the course is	offered and in the su	bsequent semester		
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	immes)			
Module	e appea	irs in					
Master	's degr	ee (1 major) Mathemati	cs (2016)				
Master	's degre	ee (1 major) Economath	ematics (2016)				
Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gympasium MINT Teacher Education DLUS, Elite Network, Payaria (ENP) (2006)							
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Master's degree (1 major) Mathematics (2019)							
Master	's teacl	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	020)	
Supple	mentar	y course MINT Teacher	Education PLUS, Elite	Network Bavaria (ENI	8) (2020)		
master	s aegro	ee (1 major) wathemati	lai Miysics (2020)			I	
Master's wi (2025)	ith 1 majoi	Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam • ECTS) Mathematical Data Sci	. reg. data re- ience - 2025	page 107 / 148	

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)
Module title					Abbreviation	
Seminar in Non-linear Analysis				10-M=SNLA-161-mc)1	
Modul	e coord	inator		Module offered by		
Dean c	of Studi	es Mathematik (Mathe	matics)	Institute of Mathem	atics	
ECTS	Meth	od of grading	Only after succ. con	pl. of module(s)		
5	nume	rical grade		1 (7		
Duratio	on	Module level	Other prerequisites			
1 seme	ester	graduate				
Conter	Contents					
A mod	ern top	ic in non-linear analysis	5.			
Recom Depen doubt,	mende ding or it is re	d previous knowledge: 1 the content, basic and commended to consult	l advanced knowledge the lecturer.	from different areas	of analysis is require	ed. In case of
Intend	ed lear	ning outcomes				
The stu	udent is	able to elaborate a co	ntemporary research to	pic. This includes co	omprehending and s	tructuring of
the top	bic and	the available literature	, preparing a talk and t	ne ability to participa	ate in a scientific dis	cussion.
Course	es (type, i	number of weekly contact hour	s, language — if other than Ger	man)		
S (2) Moduli	e taugh	t in: German and/or En	σlish			
Metho	d of as		ulago — if other than German	avamination offered — if no	t overv comester informati	ion on whothor
module i	s credital	ble for bonus)	uage – il other than German,		it every semester, informati	ion on whether
talk (6	o to 120	o minutes)				
Langua	age of a	ssessment: German or	English			
Assess	sment c	offered: In the semester	in which the course is	offered and in the su	ibsequent semester	
Allocat	tion of	places				
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	mmes)		
Module appears in						
Master's degree (1 major) Mathematics (2016)						
Master's degree (1 major) Economathematics (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS Elite Network Ravaria (ENR) (2016)						
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master's degree (1 major) Mathematics (2019)						
Master	Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)					
Supple	ementa	ry course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2020)	
Master	r's degr	ee (1 major) Mathemati	cal Physics (2020)			
Imaster	s degr	ee (1 major) Economatr	iematics (2021)			
Master's w (2025)	vith 1 majo	r Mathematical Data Science	JMU Würzburg • ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	n. reg. data re- ience - 2025	page 109 / 148

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)



Subfield Computer Science

(15 ECTS credits)

Module title Abbreviation					Abbreviation
Programming with neural nets					10-I=PNN-252-m01
Module	coord	inator		Module offered by	
holder	of the C	hair of Computer Scienc	e VI	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Overvie NN-arcł	w over nitectu	NN, implementation of in res, among others in the	mportant NN-archited area of image and lar	tures like FCN, CNN guage processing.	and LSTMs, practical example for
Intende	ed learr	ning outcomes			
Knowle and how rature,	dge ab w they to prep	out possible applications are implemented in NN-to are data and solve concr	s and limitations of N ools like Tensorflow/ ete tasks for NN.	N, for important arch Keras, ability to prog	nitectures (eg. FCN, CNN, LSTM) gram network structures from lite-
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) +	Ü (2)				
Method module is	l of ass creditab	essment (type, scope, langua, le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
written If annoi examin prox. 15 Langua credital	examir unced l ation o 5 minut ge of a ble for	nation (approx. 60 to 120 by the lecturer at the beg f one candidate each (ap es per candidate). ssessment: German and/ bonus	minutes) inning of the course, prox. 20 minutes) or ′or English	the written examina an oral examination	tion may be replaced by an oral in groups of 2 candidates (ap-
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Focuses IT, KI, H	s availa CI, GE,	able for students of the M IN	laster's programme li	nformatik (Computer	Science, 120 ECTS credits): SE,
Workload					
150 h					
Teaching cycle					
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	rs in			
Master'	s degre	ee (1 major) Information S	Systems (2025)		

Module title					Abbreviation
Algorit	nms fo	r Geographic Information	Systems		10-I=AGIS-232-m01
Module	coord	inator		Module offered by	
holder	of the O	Chair of Computer Science	e l	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate			
Conten	ts				
Algorith sition, p misatio tial plar	imic fo process n. App nning a	undations of geographic sing, analysis and presen lications such as the crea is well as cartographic ge	information systems tation of spatial info ation of digital height neralisation.	and their applicatio rmation. Processes o models, working wi	n in selected problems of acqui- of discrete and continuous opti- th GPS trajectories, tasks of spa-
Intende	ed learr	ning outcomes			
The stu to selec	dents a t and i	are able to formalise algo mprove suitable approac	rithmic problems in t hes to solving these	he field of geograph problems.	ic information systems as well as
Courses	5 (type, n	umber of weekly contact hours, la	anguage — if other than Ger	man)	
V (2) + l	Ü (2)				
Method module is	l of ass creditab	s essment (type, scope, languag le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
If annou examin prox. 15 Langua credital	examir unced l ation o ; minut ge of a ole for	nation (approx. 60 to 120 by the lecturer at the beg f one candidate each (ap es per candidate). ssessment: German and/ bonus	minutes) inning of the course, prox. 20 minutes) or ′or English	the written examina an oral examination	tion may be replaced by an oral in groups of 2 candidates (ap-
Allocati	ion of p	olaces			
Additio	nal info	ormation			
Focuses AT,KI,H	s availa CI,LR,II	able for students of the M N	laster's programme Ir	nformatik (Computer	Science, 120 ECTS credits):
Worklo	ad				
150 h	150 h				
Teaching cycle					
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	irs in			
Master'	s degre	ee (1 major) Computer Sc	ience (2023)	`	
Master'	s degre	ee (1 major) Computation	al Mathematics (202	4)	
master's degree (1 major) mathematics (2024)					

Module title				Abbreviation	
Computational Geometry					10-l=AG-232-m01
Module	coord	inator		Module offered by	
holder	of the O	Chair of Computer Scienc	e l	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate			
Conten	ts				
In many formatio algorith gorithm ve.	v areas on syst mic as is and	of computer science fo tems it is necessary to s pects of these tasks: We data structures. Every teo	or example robotics, c store, analyse, create will acquire techniqu hnique will be illustr	computer graphics, v or manipulate spati ues that are needed t ated with a problem	rirtual reality and geographic in- al data. This class is about the to plan and analyse geometric al- in the practical areas listed abo-
Intende	d lear	ning outcomes			
The stu metric p based c	dents a probler on the o	are able to decide which n. The students are able concepts and techniques	algorithms or data sti to analyse new proble acquired in the lectu	ructures are suitable ems and to come up ıre.	for the solution of a given geo- with their own efficient solutions
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) + ĺ	Ü (2)				
Method module is	l of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
written If annou examin prox. 15 Langua credital	examir unced l ation o ; minut ge of a ole for	nation (approx. 60 to 120 by the lecturer at the beg of one candidate each (ap res per candidate). ssessment: German and, bonus	minutes). inning of the course, prox. 20 minutes) or /or English	the written examina an oral examination	tion may be replaced by an oral in groups of 2 candidates (ap-
Allocati	ion of p	olaces			
Additio	nal info	ormation			
Focuses AT,HCI,	s availa GE,IN	able for students of the N	laster's programme lr	nformatik (Computer	Science, 120 ECTS credits):
Worklo	ad				
150 h					
Teachin	ig cycl	e			
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	appea	nrs in			
Module studies (Master) Computer Science (2019) Master's degree (1 major) Computer Science (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)					

Approximation Algorithms to-I=APA-161-mo1 Module correlinator Module offered by holder of the Chair of Computer Science Institute of Computer Science ECTS Method of grading Only after succ. compl. of module(s)	Module title			Abbreviation			
Module coordinator Module offered by holder of the Chair of Computer Science Institute of Computer Science ECTS Metrodo of grading Only after succ. compl. of module(s) numerical grade Duration Module level Other prerequisites 1 semester graduate The task of finding the optimal solution for a given problem is onnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution at ways give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming. Interded learning outcomes Courses type, number of weekly contact hours, language – if other than Geman) V (2) + 0 (2) Method of assessment (type, scope, language – if other than Geman) Written examination of approx. Go to 120 minutes). If anot outper science, information on whether imdule is certalise to hours, language – if other than Geman) V (2) + 0 (2) Method of assessment (type, scope, language – if other than Geman) V(2) + 0 (2) Method of one candidate each (approx. 20 minutes) or an oral ex	Approximation Algorithms 10					10-I=APA-161-m01	
holder of the Chair of Computer Science I Institute of Computer Science ECTS Method of grading Only after succ. compl. of module(s) s numerical grade Contemts I semester graduate Contemts The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss are used which do not always give the optimal solution but always give good solutions. This lecture will discuss are used which do not always give the optimal solution but always give good solutions. This lecture will discuss are used which do not always give the optimal solution but always give good solutions. This lecture will discuss are used which do not always agive the optimal solution but always give good solutions. This lecture will discuss are used which do not always agive the optimal solution but always give good solutions. This lecture will discuss are used which do not always give the optimal solution but always give good solutions. This lecture will discuss are alse to analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search scaling as well as methods based on linear pro- gramming and are able to apply these to new problems. Courses (type, number of weekly contact hours, language – if other than German, examination affered – if not every senester, information on whether module is conditable for bonus written examination (approx. 6o to 120 minutes). If announced by the lecture at the beginning of the course, the written examination in groups of 2 candidates (ap- prox. 15 minutes per candidate). Inguage of assessment (programma Informatik (Computer Science, 120 ECTS credits): ATI-ECE Additional information	Module coordinator			Module offered by			
ECTS Methe⊎ f grading Only after succ. compl. of module(s) 5 num=rical grade Duration Module level Other prerequisites 1 semester graduate Contents Contents Contents Contents	holder	of the C	Chair of Computer Scier	ice l	Institute of Comput	er Science	
5 numerical grade Duration Module level Other prerequisites 1 semester graduate Contents The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimes, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming. Intended learning outcomes	ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
Duration Module level Other prerequisites 1 semester graduate Contents The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming. Intended learning outcomes The students are able to analyse easy approximation methods in terms of their quality. They understand fundamental drafting techniques such as greedy, local search and scaling as well as methods based on linear programming and are able to apply these to new problems. Courses (type, number of weekly contact hours, language – if other than German) V (2) + 0 (2) Method of assessment (type, scope, language – if other than German, examination of one candidate each (approx. 2) or an oral examination in of one candidate each (approx. 2) or an oral examination may be replaced by an oral examination of one candidate each (approx. 2) or an oral examination in groups of 2 candidates (approx. 3) minutes) or an oral examination in groups of 2 candidates (approx. 3) minutes) or an oral examination in groups of 2 candidates (approx. 4) minutes per candidates (approx. 5) minutes per candidates (approx. 2) minutes) or an oral examination in groups	5	nume	rical grade				
n semester graduate	Duratio	n	Module level	Other prerequisites	i		
Contents The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will lintAcue students to inportant drafting techniques such as greedy, local search, scaling as well as methods based on linear programming. Intendel learning outcomes The students are able to analyse easy approximation methods in terms of their quality. They understand fundamental drafting techniques such as greedy, local search and scaling as well as methods based on linear programming and are able to apply these to new problems. Courses (type, number of weekly contact hours, language – if other than German) Y (2) + ij (2) Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) written examination (approx. 6o to 120 minutes)). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus Aldication of place Aldication of place Jone Jone Jone Jone Jone Jone Jone Jone	1 seme	ster	graduate				
The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming. Intended learning outcomes The students are able to analyse easy approximation methods in terms of their quality. They understand fundamental drafting techniques such as greedy, local search and scaling as well as methods based on linear programming and are able to apply these to new problems. Courses (type, number of weekly contact hours, language – if other than German) V (2) + Ü (2) Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) written examination (approx. 6o to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate). Language of assessment: German and/or English creditable for bonus Allocation of places	Conten	ts					
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V (2) + Ú (2) Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (ap- prox. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus Allocation of places Additional information Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,IT,GE Workload 150 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes) Module appears in Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 majo	Course	S (type, n	umber of weekly contact hours	, language — if other than Ge	rman)		
Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (ap- prox. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus Allocation of places Additional information Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,IT,GE Workload 150 h Teaching cycle Referred to in LPO I (examination for teaching-degree programmes) Module appears in Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Comput	V (2) +	Ü (2)					
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Master's with 1 major Mathematical Data Science JMU Würzburg • generated 14-Dez-2024 • exam. reg. data re- cord Master (120 ECTS) Mathematical Data Science - 2025 page 115 / 148	Master's wi (2025)	th 1 major	Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	i. reg. data re- ience - 2025	page 115 / 148

Master's degree (1 major) Computer Science (2018)

Module studies (Master) Computer Science (2019)

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) Computer Science (2021)

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

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

Master's degree (1 major) Computer Science (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	
Visualization of Graphs				10-l=VG-161-m01		
Module	e coord	inator		Module offered by		
holder	of the (Chair of Computer Scier	nce l	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade		•		
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts	Sidduite				
This co phenth the plan as well	urse co <i>eorie (</i> / nar sep as algo	overs the most importan Algorithmic Graph Theo barator theorem will be prithms to optimise the	nt algorithms to draw g ry) such as divide and used. We will become se measures.	raphs. Methods from conquer, flow netwo familiar with measur	n the course <i>Algorith</i> orks, integer program res of quality of a gra	mische Gra- iming and aph drawing
Intende	ed lear	ning outcomes				
The par their kr	ticipar lowled	its get an overview of g ge about the modelling	raph visualisation and and solving of probler	become familiar witl ns with the help of g	n typical tools. They raphs and graph alg	consolidate orithms.
Course	S (type, r	number of weekly contact hours	s, language — if other than Gei	rman)		
V (2) +	Ü (2)					
Methoo module is	d of ass creditab	sessment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
examin prox. 15 Langua credita	ation c 5 minut ge of a ble for	of one candidate each (es per candidate). ssessment: German an bonus	approx. 20 minutes) or d/or English	an oral examination	in groups of 2 cand	idates (ap-
Allocat	ion of _l	olaces				
Additio	nal inf	ormation				
Focuse: AT,IT,H	s availa CI , GE	able for students of the	Master's programme l	nformatik (Computer	Science, 120 ECTS (credits):
Worklo	ad					
150 h			,			
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)		
Module appears in						
Master's degree (1 major) Computer Science (2016)						
Master's degree (1 major) Mathematics (2016)						
Master's degree (1 major) Computational Mathematics (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Supple	Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)					
Master	Master's degree (1 major) Computer Science (2017)					
Master	s degr	ee (1 major) Computer S	ocience (2018)	-)		
Master	s degr	ee (1 major) Computatio	onal Mathematics (201	9)		
Master's wi	s aegr	ee (1 major) wathemati	LS (2019) IMU Würzburg • ص	enerated 14-Dez-2024 • exam	. reg. data re-	page 117 / 148
(2025)			cord Master (120	ECTS) Mathematical Data Sc	ience - 2025	,, ,, ,

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) Computer Science (2021)

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

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

Master's degree (1 major) Computer Science (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	
Selecte	d Topi	cs in Theory			10-I=AKT-232-m01	
Module	coord	inator		Module offered by		
holder	of the C	Chair of Computer Science	e l	Institute of Compute	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	numei	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Conten	ts					
Selecte	d topic	s in theory.				
Intende	ed learn	ning outcomes				
The stu solution	dents ເ າs of cc	understand the basic app omplex problems in this a	proach of theoretical of theoretical of theoretical of the second s	computer science. Th to similar questions.	ney are able to understand the	
Courses	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (2) + l	Ü (2)					
Method module is	l of ass creditab	e essment (type, scope, langua ₎ le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
b) proje the topi c) oral e d) oral e Langua credital	ect worl ic) or examin examin ge of a ble for	k (report (approx. 20 pag ation of one candidate ea ation in groups of up to g ssessment: German and/ bonus	ach (approx. 20 minu ach (approx. 20 minu achdidates (approx for English	(30 to 45 minutes) a tes) or . 15 minutes per cano	and subsequent discussion on didate)	
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Focuses AT	s availa	able for students of the M	aster's programme li	nformatik (Computer	Science, 120 ECTS credits):	
Worklo	ad					
150 h						
Teachir	ng cycle	9				
	<u> </u>					
Referre	d to in	IPOI (examination regulations	for teaching-degree progra	mmes)		
Module appears in						
Module studies (Master) Computer Science (2010)						
Master'	Master's degree (1 major) Computer Science (2023)					
Master'	Master's degree (1 major) Aerospace Computer Science (2023)					
Master'	s degre	ee (1 major) Computation	al Mathematics (202	4)		
Master'	s degre	ee (1 major) Mathematics	(2024)			
Master'	s teach	ning degree Gymnasium I	MINT Teacher Educati	on PLUS, Elite Netwo	ork Bavaria (ENB) (2025)	
Supple	mentar	y course MINT Teacher Ed	ducation PLUS, Elite I	Network Bavaria (ENI	B) (2025)	

Module title					Abbreviation	
Machin	e Leari	ning for Natural Langua	age Processing		10-I=NLP-212-m01	
Module	e coord	inator		Module offered by		
holder	of the (Chair of Computer Scier	псе Х	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
The lec ents sta ground almost beddin ke CNN training applica Intende The par and are Course V (2) + Methoo written If anno examin prox. 19 Langua credita	The lecture conveys advanced knowledge about methods in computational text processing. To this end, it presents state of the art models and techniques in the area of machine learning, as well as their technical back- ground, and their respective applications in Natural Language Processing. As one important building block of almost all modern NLP-models, different techniques for learning representations of words, so called Word Em- beddings, are presented. Starting from this we cover, among others, models from the area of Deep Learning, li- ke CNNs, RNNs and Sequence-to-Sequence architectures. The theoretical foundations of these models, like their training with Backpropagation, are also covered in depth. For all models presented in the lecture, we show their application to problems like sentiment analysis, text generation and machine translation in practice. Intended learning outcomes The participants have solid knowledge on problems and methods in the area of computational text processing and are able to identify and apply suitable methods for a specific task. Courses (type, number of weekly contact hours, language – if other than German) V (2) + Ü (2) Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) written examination (approx. 60 to 120 minutes) If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (ap- prox. 15 minutes per candidate).					
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Focuse AT,KI,H	s availa Cl	able for students of the	Master's programme I	nformatik (Computer	Science, 120 ECTS o	credits):
Worklo	ad					
150 h						
Teachi	ıg cycl	е				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	e appea	urs in				
Module studies (Master) Computer Science (2019)						
Master	Master's degree (1 major) Computer Science (2021)					
Master	Master's degree (1 major) Computational Mathematics (2022)					
Master	s degr	ee (1 major) Information	1 Systems (2022)			
Mastoria	5 uegro			enerated 1/ Doz acor a over	reg data ro	name 120 / 4/9
(2025)	ai i majul		cord Master (120	ECTS) Mathematical Data Sc	ience - 2025	puge 120 / 140

Master's degree (1 major) Computer Science (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Management (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Information Systems (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) Information Systems (2025) Master's degree (1 major) Information Systems (2025) Master's degree (1 major) Management (2025)

Module title				Abbreviation		
NLP and Text Mining				10-I=STM-162-m01		
Module coordinator Module offered by			Module offered by			
holder	of the (Chair of Computer Scier	ice VI	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts	0	ļ			
Founda tection stic par The stu text min taught.	itions i , token rsing, w dents ning an They h	n the following areas: d isation, collocation, N-s yord sense disambiguat cossess theoretical and id language processing ave gained experience	efinition of NLP and te gram models, morphole ion, term extraction m I practical knowledge a mostly for English. The in the application of te	xt mining, properties ogy, hidden Markov ethods, information about typical method ey are able to solve p ext mining algorithms	of text, sentence bo models for tagging, p extraction, sentimer is and algorithms in problems through the s.	oundary de- probabili- nt analysis. the area of e methods
Intende	ed lear	ning outcomes				
The stu text min class. T	dents ning an They ha	oossess theoretical and d language processing ve gained experience ii	l practical knowledge a . They are able to solve n the application of tex	about typical method practical problems t mining algorithms.	ls and algorithms in with the methods ac	the area of quired in
Course	S (type, r	umber of weekly contact hours	, language — if other than Ger	rman)		
V (2) +	Ü (2)					
Methoo module is	d of ass creditab	essment (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether
written If anno examin prox. 19 Langua	examin unced ation c 5 minut ge of a	nation (approx. 60 to 12 by the lecturer at the be if one candidate each (es per candidate). ssessment: German an	o minutes). ginning of the course, approx. 20 minutes) or d/or English	the written examina an oral examination	tion may be replaced in groups of 2 cand	d by an oral idates (ap-
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Focuse IT, HCI.	s availa	able for students of the	Master's programme l	nformatik (Computer	Science, 120 ECTS o	credits): AT,
Worklo	ad					
150 h						
Teachi	ng cvcl	6				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2010)						
Master	's degr	ee (1 major) Information	n Systems (2019)			
Master	's teacl	ning degree Gymnasiun	n MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	020)
Master's wi (2025)	ith 1 majo	Mathematical Data Science	JMU Würzburg ● ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	. reg. data re- ience - 2025	page 122 / 148



Master's degree (1 major) Computer Science (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Information Systems (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Computer Science (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Information Systems (2024) Master's degree (1 major) Information Systems (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
Statistical Network Analysis					10-l=SNA-232-m01
Module	e coord	inator		Module offered by	
holder	of the (Chair of Computer Scienc	e XV	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. compl. of module(s)		
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites	i	
1 seme	ster	graduate			
Contents					
Networ formati	Networks matter! This holds for technical infrastructures like communication or transportation networks, for in- formation systems and social media in the World Wide Web, but also for various social, economic and biologi-				

formation systems and social media in the World Wide Web, but also for various social, economic and biological systems. What can we learn from data that capture the interaction topology of such complex systems? What is the role of individual nodes and how can we discover significant patterns in the structure of networks? How do these structures influence dynamical process like diffusion or the spreading of epidemics? Which are the most influential actors in a social network? And how can we analyze time series data on systems with dynamic network topologies?

Addressing those questions, the course combines a series of lectures -- which introduce fundamental concepts for the statistical modelling of complex networks -- with weekly exercises that show how we can apply them to practical network analysis tasks. Topics covered include foundations of graph theory, centrality and modulari-ty measures, aggregate statistical characteristics of large networks, random graphs and statistical ensembles of complex networks, generating function analysis of expected graph properties, scale-free networks, stochastic dynamics in networks, spectral analysis, as well as the modelling of time-varying networks. The course material consists of annotated slides for lectures as well as a accompanying git-Repository of jupyter notebooks, which implement and validate the theoretical concepts covered in the lectures. Students can test and deepen their knowledge through weekly exercise sheets. The successful completion of the course requires to pass a final written exam.

Intended learning outcomes

The course will equip participants with statistical network analysis techniques that are needed for the data-driven modelling of complex technical, social, and biological systems. Students will understand how we can quantitatively model the topology of networked systems and how we can detect and characterize topological patterns. Participants will learn how to use analytical methods to make statements about the expected properties of very large networks that are generated based on different stochastic models. They further gain an analytical understanding of how the structure of networks shapes dynamical processes, how statistical fluctuations in degree distributions influence the robustness of systems, and how emergent network features emerge from simple random processes.

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

V (2) + Ü (2)

Module taught in: 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)

written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: English

creditable for bonus

Allocation of places

Additional information

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): IN

Master's with 1 major Mathematical Data Science	JMU Würzburg • generated 14-Dez-2024 • exam. reg. data re-	page 124 / 148
(2025)	cord Master (120 ECTS) Mathematical Data Science - 2025	

Workload

150 h

Teaching cycle

n

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

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Module appears in

Master's degree (1 major) Information Systems (2019) Master's degree (1 major) Information Systems (2022) Master's degree (1 major) Computer Science (2023) Master's degree (1 major) Aerospace Computer Science (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Management (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Information Systems (2024) Master's degree (1 major) Economathematics (2024) Master's degree (1 major) Information Systems (2024) Master's degree (1 major) Information Systems (2025) Master's degree (1 major) Management (2025)

Module title Abbreviation					
Introduction in Al 10-Al=IAI-242-mo1					10-AI=IAI-242-m01
Module	coord	inator		Module offered by	
Dean of	Studie	es Informatik (Computer S	Science)	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate			
Conten	ts				
Essentia ging fro	al conc m clas	epts and algorithms of a sical simple heuristic me	rtificial intelligence. thods to more compl	Theoretical or practic ex probabilistic mod	cal competences are taught, ran- lels of artificial intelligence.
Intende	d learr	ning outcomes			
The stu tify and	dents ł apply	nave theoretical and prac appropriate methods to s	tical knowledge in th solve problems in the	e field of artificial in field of AI.	telligence. They are able to iden-
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) + ĺ Module	Ü (2) taugh	t in: German and/or Engli	ish		
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)			, ,
Written If annou examina prox. 15 Langua credital	examin unced l ation o minut ge of a ole for	nation (approx. 60 to 120 by the lecturer at the beg f one candidate each (ap es per candidate). ssessment: German and/ bonus	o minutes) inning of the course, prox. 20 minutes) or [/] or English	the written examina an oral examination	tion may be replaced by an oral in groups of 2 candidates (ap-
Allocati	ion of p	olaces			
Additio	nal info	ormation			
Workload					
150 h					
Teaching cycle					
Teachin	Teaching cycle: every year, winter semester				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	irs in			
Master's degree (1 major) Artificial Intelligence (2024)					

Module title Abbreviation					
Semina	ır Artifi	cial Intelligence			10-Al=SEM1-242-m01
Module	coord	inator		Module offered by	
Dean of	fStudi	es Informatik (Computer S	Science)	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Indepe with wr	ndent r itten ar	eview of a current artifici nd oral presentation.	al intelligence topic b	based on literature a	nd, where applicable, software
Intende	ed leari	ning outcomes			
The stu aspects	dents a s in wri	are able to independently tten form and to orally pr	/ review a current arti esent these in an app	ficial intelligence top propriate way.	pic, to summarise the main
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
S (2) Module	taugh	t in: German and/or Engl	ish		
Methoo module is	l of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
Term pa Langua credita	aper (10 ge of a ble for	o to 15 pages) and preser ssessment: German and, bonus	ntation (30 to 45 minu /or English	utes) followed by a d	iscussion on the topic
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
150 h					
Teachir	Teaching cycle				
Teachir	Teaching cycle: every semester				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	in in			
Master	Master's degree (1 major) Artificial Intelligence (2024)				

Module title					Abbreviation	
Compu	Computer Vision 1 10-AI=CV1-242-m01					L
Module	e coord	inator		Module offered by		
holder of the Chair of Computer Science IV Ins			Institute of Comput	er Science		
ECTS	Methe	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 seme	ster	graduate				
Conten	Its					
The lec basics taught. Topics image Actual respec	ture pr as well include and vid models tive app	ovides knowledge abo as the most recent ap e data representation, i leo understanding, dee s and methods of mach plications in Computer	ut current methods and proaches to image repr mage acquisition, rest p learning and generat ine learning as well as Vision are shown.	l algorithms in the fid esentation, image pr oration and enhance ive methods and ap their technical backs	eld of computer visic rocessing and image ment, features, obje plications. grounds are presente	in. Important analysis are ect modeling, ed and their
Intend	ed lear	ning outcomes				
Studen to inde • (a • (• F	nts have pender Dvervie algorith Gaining Providir	e fundamental knowled ntly identify and apply w of the most importan ms from Computer Visi experience through ho ng a sound solid backg	lge of problems and teo suitable methods for co t concepts of image rep on ome assignments, pract round knowledge for th	chniques in the field oncrete problems. presentation, image a tical computer and p e advanced Comput	of computer vision a malysis, machine lea rogramming exercise er Vision 2 course	and are able arning and es
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V (2) +	Ü (2)	· · · · · · · · ·				
Module	e taugh	t in: English				
Metho	d of ass	sessment (type, scope, lang	guage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
Writter If anno examir prox. 1 Langua credita	n exami nation of 5 minut age of a ble for	nation (approx. 60 to 1 by the lecturer at the b of one candidate each (tes per candidate). ssessment: English bonus	20 minutes) eginning of the course, approx. 20 minutes) or	the written examina an oral examinatior	tion may be replaced in groups of 2 cand	d by an oral idates (ap-
Allocat	ion of _l	places				
Additio	onal inf	ormation				
Worklo	ad					
150 h	150 h					
Teaching cycle						
Teaching cycle: every year, summer semester						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	e appea	ars in				
Master Master	's degr 's degr	ee (1 major) Artificial In ee (1 major) Artificial In	telligence & Extended telligence (2024)	Reality (2024)		
Master's w (2025)	ith 1 majo	r Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam 9 ECTS) Mathematical Data Sc	n. reg. data re- ience - 2025	page 128 / 148



Master's degree (1 major) Management (2024) Master's degree (1 major) Information Systems (2024) Master's degree (1 major) Economathematics (2024) Master's degree (1 major) Information Systems (2025) Master's degree (1 major) Management (2025)

Module title					Abbreviation	
Compu	Computer Vision 2 10-AI=CV2-242-mo1					
Module	coord	inator		Module offered by		
holder	of the C	Chair of Computer Science	e IV	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
vances vances	The lecture provides knowledge about current state-of-the-art in the field of computer vision. The most recent ad- vances are taught. The topics that will be covered are: review of computer vision review of deep learning classification, detection, recognition motion and tracking geometry and 2D/3D modeling segmentation lightfields and neural radiance fields generative methods and diffusion models transformers and foundation models efficiency and explainability applications 					
Intende	ed learn	ning outcomes	own.			
Studen indepe • C p	ts have ndently verviev uter Vis	e advanced knowledge of videntify and apply suita w of the main concepts a sion	problems and techn ble methods for conc nd state-of-the-art m me assignments, pra	iques in the field of or rete problems. achine learning moc	computer vision and are able to lels and algorithms from Com-	
Course	S (type n	umber of weekly contact hours	anguage — if other than Ger	man)		
V (2) + Module	Ü (2) e taugh	t in: English				
Methoo module is	d of ass creditab	e essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
Written If annou examin prox. 15 Langua credital	Written examination (approx. 60 to 120 minutes) If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (ap- prox. 15 minutes per candidate). Language of assessment: English creditable for bonus					
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
150 h	150 h					

Teaching cycle

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Teaching cycle: every year, winter semester

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

Module appears in

Master's degree (1 major) Artificial Intelligence & Extended Reality (2024) Master's degree (1 major) Artificial Intelligence (2024)

Module title				Abbreviation	
Machin	Machine Learning for Networks 1 10-I=MLN1-232-m01				
Module	e coord	inator		Module offered by	
holder	of the C	Chair of Computer Scienc	e XV	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Networ formati cal syst is the ro these s influent work to Addres for the practica ty meas of comp stic dyr terial co which i their kn written	Networks matter! This holds for technical infrastructures like communication or transportation networks, for in- formation systems and social media in the World Wide Web, but also for various social, economic and biologi- cal systems. What can we learn from data that capture the interaction topology of such complex systems? What is the role of individual nodes and how can we discover significant patterns in the structure of networks? How do these structures influence dynamical process like diffusion or the spreading of epidemics? Which are the most influential actors in a social network? And how can we analyze time series data on systems with dynamic net- work topologies? Addressing those questions, the course combines a series of lectures which introduce fundamental concepts for the statistical modelling of complex networks with weekly exercises that show how we can apply them to practical network analysis tasks. Topics covered include foundations of graph theory, centrality and modulari- ty measures, aggregate statistical characteristics of large networks, random graphs and statistical ensembles of complex networks, generating function analysis of expected graph properties, scale-free networks, stocha- stic dynamics in networks, spectral analysis, as well as the modelling of time-varying networks. The course ma- terial consists of annotated slides for lectures as well as a accompanying git-Repository of jupyter notebooks, which implement and validate the theoretical concepts covered in the lectures. Students can test and deepen their knowledge through weekly exercise sheets. The successful completion of the course requires to pass a final				
Intende	ed learr	ning outcomes			
titative terns. P very lar derstar distribu dom pr	drse wil delling ly mode Particip ge netw ding o utions i ocesse	Il equip participants with of complex technical, so el the topology of networ ants will learn how to use works that are generated f how the structure of net nfluence the robustness s.	statistical network a bocial, and biological s ked systems and how e analytical methods based on different st tworks shapes dynam of systems, and how	nalysis techniques to systems. Students wi v we can detect and to make statements cochastic models. Th nical processes, how emergent network fo	hat are needed for the data-dri- ill understand how we can quan- characterize topological pat- about the expected properties of ey further gain an analytical un- statistical fluctuations in degree eatures emerge from simple ran-
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)	
V (2) + Module	Ü (2) e taugh	t in: English			
Method module is written If annot examin	Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) written examination (approx. 60 to 120 minutes) If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (ap-				
Langua credita	prox. 15 minutes per candidate). Language of assessment: English creditable for bonus				
Allocat	ion of p	olaces			

Additional information

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,IT,SE,KI,HCI,IN

Workload

150 h

Teaching cycle

Teaching cycle: every year, summer semester

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

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Module appears in

Master's degree (1 major) Information Systems (2019) Master's degree (1 major) Information Systems (2022) Master's degree (1 major) Computer Science (2023) Master's degree (1 major) Artificial Intelligence & Extended Reality (2024) Master's degree (1 major) Artificial Intelligence (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Information Systems (2024) Master's degree (1 major) Information Systems (2025)

Module title					Abbreviation	
Machine Learning for Networks 2					10-I=MLN2-232-m01	
Module	coord	nator		Module offered by	ule offered by	
holder	of the C	hair of Computer Scienc	e XV	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Conten	ts					
Graph r chine le dules ir address cal lear similari use ma tain a m ning teo Address statistic we can and a s Intende	Graph representations of relational data have become an important foundation to address data science and ma- chine learning tasks across the sciences. Graph mining and learning techniques help us to detect functional mo- dules in biological networks and communities in social networks, to find missing links in social networks, or to address node-, link-, or graph-level classification tasks. But how can we apply frequentist and Bayesian statisti- cal learning techniques to data on complex networks? And how we can use the topology of relationships to infer similarity scores between objects that can, e.g., be used for the design of recommender systems? How can we use matrix factorization techniques to generate low-dimensional vector-space representations of nodes that re- tain a maximum amount of information about the topology of links? And how can we apply the latest deep lear- ning techniques to address node-, link-, or graph-level learning tasks in data with relation structures? Addressing these questions, this course combines a series of lectures - which introduce theoretical concepts in statistical learning, representation learning, and graph neural networks with practice sessions that show how we can apply them in practical graph learning tasks. The course material consists of annotated slides for lectures and a series of accompanying jupyter notebooks. Intended learning outcomes					
on com to infer on and learn lo works h dents c course	plex ne cluster graph i w-dime ielp us an app require	etworks. Students will lea pattern and how topolog reconstruction. Participal ensional vector-space rep to apply deep learning to ly and deepen their know s to pass a final written e	Irn how statistical lea gical similarity scores nts will further study presentations of grap o node- and graph-lev vledge through weekl exam.	rning and data comp can be used to add both algebraic and d h-structured data, an rel learning tasks in y exercise sheets. Th	pression techniques can be used ress unsupervised link predicti- leep learning based methods to nd learn how graph neural net- large complex networks. Stu- ne successful completion of the	
Course	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (2) + I	Ü(2)					
Module Method module is	taught l of ass creditab	t in: English essment (type, scope, langua; le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
written If annou examin prox. 15 Langua credital	written examination (approx. 60 to 120 minutes) If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (ap- prox. 15 minutes per candidate). Language of assessment: English creditable for bonus					
Allocati	ion of p	laces				
Additio	nal info	ormation				
Focuses AT,IT,SE	s availa E,KI,HC	ble for students of the M I,IN	laster's programme Ir	nformatik (Computer	Science, 120 ECTS credits):	

Workload

150 h

Teaching cycle

Teaching cycle: if announced

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

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Module appears in

Master's degree (1 major) Computer Science (2023)

Master's degree (1 major) Artificial Intelligence & Extended Reality (2024)

Master's degree (1 major) Artificial Intelligence (2024)

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

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

Module title					Abbreviation	
Image	Image Processing and Computational Photography 10-I=IP-222-m01					
Modul	e coord	inator		Module offered by		
holder	of the (Chair of Computer Scier	nce IV	Institute of Comput	er Science	
ECTS Method of grading Only after succ. compl. of module(s)						
5	nume	rical grade				
Durati	on	Module level	Other prerequisites			
1 seme	ester	graduate				
Conter	nts					
Its und its und i i i i i i i i i i i i i	 its underlying concepts, including the recent use of deep learning. The topics that will be covered are: introduction to image processing and computational photography sampling and quantization light and color image acquisition deep learning generative methods image restoration sensor and image quality assessment image compression applications Intended learning outcomes Students have fundamental knowledge of problems and techniques in the field of image processing and computational photography and are able to independently identify and apply suitable methods for concrete problems. Overview of the most important concepts of image formation, perception and analysis, and Computation pair Debetography 					
• Course	Providir es (type, r	ig a sound solid backgr	ound knowledge for th 5, language — if other than Ger	e Computer Vision c man)	ourses	
V (2) +	Ü (2)					
Modul	e taugh	t in: English				
Metho module i	d of ass s creditab	essment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
writter If anno examin prox. 1 Langua credita	written examination (approx. 60 to 120 minutes) If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (ap- prox. 15 minutes per candidate). Language of assessment: English creditable for bonus					
Alloca	Allocation of places					
Additi	Additional information					
Workle	Workload					
150 h						
Teachi	ng cycl	e				
Teachi	ng cycle	e: every year, winter ser	nester			
Master's w (2025)	vith 1 majo	r Mathematical Data Science	JMU Würzburg • g cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	n. reg. data re- ience - 2025	page 136 / 148

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

Module appears in

Master's degree (1 major) Information Systems (2019) Master's degree (1 major) eXtended Artificial Intelligence (xtAl) (2020) Master's degree (1 major) Information Systems (2022) Master's degree (1 major) Computer Science (2023) Master's degree (1 major) Aerospace Computer Science (2023) Master's degree (1 major) Artificial Intelligence & Extended Reality (2024) Master's degree (1 major) Artificial Intelligence (2024) Master's degree (1 major) Information Systems (2024) Master's degree (1 major) Information Systems (2025)

Module title Abbreviation					Abbreviation
Reinforcement Learning and Computational Decision Making				g	10-I=RLCDM-252-m01
Module	coordin	nator		Module offered by	
Dean of	Studies	s Informatik (Computer S	Science)	Institute of Comput	er Science
ECTS	Method	l of grading	Only after succ. com	pl. of module(s)	
5 1	numeri	cal grade			
Duration	n /	Module level	Other prerequisites		
1 semes	ter g	graduate			
Contents	S				
This cou computa under a learning	rse will ational both th and de	provide the essential n decision-making (e.g., n eoretical and empirical ecision-making, compler	otions about reinforc nulti-armed bandits, lens, providing the ri menting them with co	ement learning and recommender syster gorous mathematica oncrete examples of	further related approaches for ms). The topics will be covered al foundations of reinforcement real-world applications.
Intendeo	d learni	ng outcomes			
modern bandits ned in th on-Makin Learning games, a	algorith and rec he cours ing in sc g experi autonor	nn gann fundamental kird nms based on deep lear commender systems. Str se, and will have a deep olving real-world proble ments for solving proble mous driving, finance, re	ning techniques, and udents will know abo understanding of th ms. They will be able ems from simulated b obotics.	l Decision-Making ap ut the theoretical tre e importance of Rein to design, implemen pasic tasks to advan	pproaches such as multi-armed eatment of the methods explai- nforcement Learning and Decisi- nt, and conduct Reinforcement ced real-world applications, e.g.,
Courses	(type, nu	mber of weekly contact hours, la	anguage — if other than Ger	man)	
V (2) + Ü Module) (2) taught i	in: German and/or Engli	sh		
Method module is c	of asse creditable	e ssment (type, scope, languag for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
written e If annou examina prox. 15 Languag creditab	examina inced by ation of minute ge of as: ole for b	ation (approx. 60 to 120 y the lecturer at the beg one candidate each (ap s per candidate). sessment: German and/ onus	minutes) inning of the course, prox. 20 minutes) or 'or English	the written examina an oral examination	tion may be replaced by an oral in groups of 2 candidates (ap-
Allocatio	on of pl	aces			
Addition	nal info	rmation			
Focuses	availat	ole for students of the M	aster's programme lr	nformatik (Computer	Science, 120 ECTS credits): IN
Workloa	Workload				
150 h	150 h				
Teaching	g cycle				
Teaching	g cycle:	every year, summer ser	nester		
Referred	d to in L	POI (examination regulations	for teaching-degree progra	mmes)	
Module	appear	s in			
keinem S	keinem Studiengang zugeordnet				

(2025)

Module title Abbreviation						
Multilingual NLP 10-I=MNLP-232-m01						1
Module coordinator Module offered by				Module offered by		
holder	of the (Chair of Computer Scier	nce XII	Institute of Comput	er Science	
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					
Langua of-spee on spa- ge Moc transla transfe pics: cu tual pa	eges of ech, syr ces (ak lels. Ma tions, p r to zer urse of ramete	the world: language fai ntax. Alphabets (scripts a cross-lingual word en achine translation. Mul parallel corpora. Cross- o-shot and few-shot tra multilinguality, modula r generation, multi-sou	nilies, typology, etymo b), encoding, and langu nbeddings). Transform tilingual resources: unl lingual transfer: from w unsfer with multilingual urization and language rce transfer, gradient n	logy. Linguistic university age identification. Mer architecture and Fabeled corpora, lexisord alignment and la Transformer-based adaptation, multilinanipulations.	ersals: words, morph Aultilingual word rep Pretrained (multilingu co-semantic network abel projection, over language models. Au gual sentence encod	nology, parts- resentati- ual) Langua- <s and="" word<br="">r MT-based dvanced to- lers, contex-</s>
Intende	ed lear	ning outcomes				
and als from di transfe solve p to obta	so get a fferent r for va ractica in best s (type, r	n insight into cutting e languages in shared re rious NLP tasks. Upon s l NLP problems regardl performance for any co	dge research in (multili presentation spaces th successful completion ess of the language of oncrete target language s, language — if other than Ger	ngual) NLP. They wil nat enable semantic of the course, the st the text data, and to e. man)	l learn how to repres comparison and cro udents will be well-e determine the optim	sent texts ss-lingual equipped to nal strategy
V (2) + Module	U (2) e taugh	t in: German and/or En	glish			
Metho	d of ass	sessment (type, scope, lang	uage — if other than German, o	examination offered — if no	t every semester, informati	ion on whether
module is	s creditab	le for bonus)				
written If anno examin prox. 19 Langua credita	examin unced nation c 5 minut uge of a ble for	nation (approx. 60 to 12 by the lecturer at the be of one candidate each (ses per candidate). ssessment: German an bonus	o minutes) eginning of the course, approx. 20 minutes) or d/or English	the written examina an oral examinatior	tion may be replaced in groups of 2 cand	d by an oral idates (ap-
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
	-					
Worklo	Workload					
150 h						
Teachi	Teaching cycle					
Teachi	Teaching cycle: every year, summer semester					
Referre	ed to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)		
Module	e appea	ars in				
Master	's degr	ee (1 major) Information	n Systems (2019)			
Master's w (2025)	ith 1 majo	r Mathematical Data Science	JMU Würzburg ● ge cord Master (120	enerated 14-Dez-2024 • exam ECTS) Mathematical Data Sc	n. reg. data re- ience - 2025	page 139 / 148



Master's degree (1 major) Information Systems (2022) Master's degree (1 major) Computer Science (2023) Master's degree (1 major) Artificial Intelligence (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Management (2024) Master's degree (1 major) Mathematics (2024) Master's degree (1 major) Information Systems (2024) Master's degree (1 major) Economathematics (2024) Master's degree (1 major) Information Systems (2025) Master's degree (1 major) Management (2025)

Module title Abbreviation					Abbreviation	
Selected Topics in AI Methods 1					10-AI=AKAIM1-242-m01	
Module coordinator Module offer						
Dean of	fStudie	es Informatik (Computer S	Science)	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Conten	ts					
Selecte	d Topio	cs in Al Methods.				
Intende	ed learr	ning outcomes				
The stu to comp	dents p olex pro	possess an advanced kno oblems in this area and to	owledge in the area o o transfer them to rel	f Al Methods. They a ated questions.	re able to understand solutions	
Courses	5 (type, n	umber of weekly contact hours, la	anguage — if other than Ger	man)		
V (2) + ĺ	Ü (2)					
Module	taugh	t in: German and/or Engli	sh			
Method module is	l of ass creditab	s essment (type, scope, languag le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writte b) proje the topi c) oral e d) oral e Langua credital	en exar ect worl ic or examin examin ge of a ole for	nination (approx. 60 to 9 k: report (approx. 20 pag ation of one candidate ea ation in groups of up to <u>3</u> ssessment: German and/ bonus	o minutes) or es) with presentation ach (approx. 20 minu 3 candidates (approx 'or English	i (30 to 45 minutes) a ites) or . 15 minutes per can	and subsequent discussion on didate).	
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
150 h	150 h					
Teachin	Teaching cycle					
Teachin	ng cycle	e: if announced				
Referre	d to in	LPOI (examination regulations	for teaching-degree progra	mmes)		
Module	Module appears in					
Master'	Naster's degree (1 major) Artificial Intelligence (2024)					

Module title Abbreviation					Abbreviation	
Selecte	d Topi	cs in Al Methods 2			10-AI=AKAIM2-242-m01	
Module coordinator Module offered by						
Dean of	fStudie	es Informatik (Computer S	Science)	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Conten	ts					
Selecte	d Topio	cs in Al Methods.				
Intende	ed learn	ning outcomes				
The stu to comp	dents p olex pro	possess an advanced kno oblems in this area and to	owledge in the area o o transfer them to rel	f Al Methods. They a ated questions.	re able to understand solutions	
Courses	5 (type, n	umber of weekly contact hours, la	anguage — if other than Ger	man)		
V (2) + İ	Ü (2)					
Module	taugh	t in: German and/or Engli	ish			
Method module is	l of ass creditab	s essment (type, scope, languag le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writte b) proje the topi c) oral e d) oral e Langua credital	en exar ect worl ic or examin examin ge of a ole for	nination (approx. 60 to 9 k: report (approx. 20 pag ation of one candidate ea ation in groups of up to <u>3</u> ssessment: German and/ bonus	o minutes) or es) with presentation ach (approx. 20 minu 3 candidates (approx ′or English	(30 to 45 minutes) a tes) or . 15 minutes per can	and subsequent discussion on didate).	
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Worklo	Workload					
150 h						
Teaching cycle						
Teachir	Teaching cycle: if announced					
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module	Module appears in					
Master's degree (1 major) Artificial Intelligence (2024)						

Module title A					Abbreviation
Self-aware Computing					10-Al=SAC-242-m01
Module coordinator				Module offered by	
Dean of	fStudi	es Informatik (Computer S	Science)	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate			
Conten	ts				
gorithm Comput such as thods for are taug	ting, Se i. e. In or evalu ght.	concepts for Self-Aware (elf-Organized Systems, o iternet of Things or Cyber uating their performance, hing outcomes	Computing Systems a r Self-Adaptive System -Physical Systems are , and how they can be	s well as related cor ms are taught. Addit e discussed. Basic c e improved through	ionputing Systems, current ar- ncepts such as e.g. Autonomic ionally, current application areas apabilities of these systems, me- the use of artificial intelligence
The par and are stems a	ticipan able t approp	ts have basic knowledge o independently identify riately.	of methods and tech and apply suitable m	nniques in the field c ethods for concrete	of Self-Aware Computing Systems problems and to evaluate sy-
Courses	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) + l Module	Ü (2) e taugh	t in: German and/or Engl	ish		
Method module is	of ass creditab	s essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
Written If annou examin prox. 15 Langua credital	exami unced l ation o minut ge of a ble for	nation (approx. 60 to 12c by the lecturer at the beg of one candidate each (ap res per candidate). ssessment: German and, bonus	o minutes) inning of the course, oprox. 20 minutes) or /or English	the written examina an oral examination	tion may be replaced by an oral in groups of 2 candidates (ap-
Allocati	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	Workload				
150 h	150 h				
Teachir	ng cycl	e			
Teachin	ng cycle	e: if announced			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	irs in			
Master's degree (1 major) Artificial Intelligence (2024)					

Module title Abbreviation					Abbreviation		
Selected Topics in AI Application & Technologies					10-AI=AKAKI-242-m01		
Module coordinator Module offered by							
Dean of	fStudie	es Informatik (Computer S	Science)	Institute of Comput	er Science		
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)			
5	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semes	ster	graduate					
Content	ts						
Selecte	d Topio	s in AI application & tech	nnologies				
Intende	ed learr	ning outcomes					
Student lutions	ts unde to com	erstand the basic approac plex problems in these a	ch to AI applications reas and transfer the	and AI technologies. m to related issues.	. They are able to understand so-		
Courses	5 (type, n	umber of weekly contact hours, la	anguage — if other than Ger	rman)			
V (2) + ĺ	Ü (2)						
Module	taugh	t in: German and/or Engli	sh				
Method module is	l of ass creditab	essment (type, scope, langua; le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether		
a) writte b) proje the topi c) oral e d) oral e Langua credital	en exar ect worl ic or examin examin ge of a ole for	nination (approx. 60 to 9 k: report (approx. 20 page ation of one candidate ea ation in groups of up to 3 ssessment: German and/ bonus	o minutes) or es) with presentation ach (approx. 20 minu 3 candidates (approx ′or English	n (30 to 45 minutes) a Ites) or . 15 minutes per can	and subsequent discussion on didate).		
Allocati	ion of p	laces					
Additio	nal info	ormation					
Worklo	ad						
150 h	150 h						
Teaching cycle							
Teachin	ng cycle	e: if announced					
Referre	d to in	LPO I (examination regulations	for teaching-degree progra	mmes)			
Module	Module appears in						
Master'	Naster's degree (1 major) Artificial Intelligence (2024)						
Module	title		Abbreviation				
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Music I	nforma	ation Retrieval			10-I=MIR-252-m01		
Module	coord	inator		Module offered by			
Dean of Studies Informatik (Computer Science)				Institute of Computer Science			
ECTS	Metho	od of grading	Only after succ. compl. of module(s)				
5 numerical grade			-				
Duration		Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
This lecture introduces the research field of Music Information Retrieval (MIR), focussing on the following topics: Music representations (graphical, symbolic, audio), basic music theory concepts, audio signal processing (esp. time-frequency transformations, variants of the Fourier transform), selected machine learning techniques, over- view and in-depth study of individual MIR tasks (e.g., harmony analysis/chord recognition, beat tracking/tempo, structure analysis, genre/style classification), data preparation/annotation and corpus analysis for digital huma- nities/musicology.							
Intende	ed leari	ning outcomes					
The students have a fundamental understanding of music representations and audio data as well as theoretical and practical knowledge in the field of audio signal processing and specialized machine learning techniques. They have gained experience with typical MIR tasks and are able to understand, develop, and apply MIR algorithms.							
Course	S (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)			
V (2) + Ü (2)							
Module	taugh	t in: German and/or Engli	ish				
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 120 minutes) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes) Language of assessment: German and/or English creditable for bonus							
Allocation of places							
Additio	nal inf	ormation					
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): GE							
Workload							
150 h							
Teaching cycle							
Teaching cycle: every year, summer semester							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
keinem Studiengang zugeordnet							

Module	title				Abbreviation		
Practica	al Cour	se - Data Science 1			10-I=PDS1-232-m01		
Module coordinator				Module offered by			
holder	of the C	Chair of Computer Scienc	e X	Institute of Computer Science			
ECTS Method of grading		Only after succ. compl. of module(s)					
10	nume	rical grade					
Duration		Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
Comple	etion of	a practical task in Data S	Science				
Intende	ed learr	ning outcomes					
The pra	ctical a	allows participants to wo	rk on a problem in Da	ta Science in teams.			
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)			
R (6)							
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)							
report (10 to 15 pages) and presentation of results (15 to 30 minutes) Language of assessment: German and/or English creditable for bonus							
Allocation of places							
Additional information							
Workload							
300 h							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master's degree (1 major) Computer Science (2023)							





Thesis (30 ECTS credits)

Module	title		Abbreviation			
Master-Thesis Mathematical Data Science					10-M=MAMDS-252-m01	
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathemat			ics) Institute of Mathematics			
ECTS	ECTS Method of grading O		Only after succ. compl. of module(s)			
30	nume	rical grade				
Duration Module level		Other prerequisites				
1 semester		graduate	The supervisor may make the successful completion of certain modu- les that are relevant for the respective topic a prerequisite for the assign- ment of the topic.			
Conten	ts					
Intende	ed leari	ning outcomes				
Courses (type, number of weekly contact hours, language — if other than German)						
No cou	rses as	signed to module				
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)						
Master's thesis (750 to 900 hours total) Registration and assignment of topic in consultation with supervisor. Language of assessment: German or English						
Allocation of places						
Additional information						
Time to complete: 6 months						
Workload						
900 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
keinem Studiengang zugeordnet						