

Module Catalogue

for the Subject

Mathematical Data Science

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

Examination regulations version: 2022 Responsible: Faculty of Mathematics and Computer Science Responsible: Institute of Mathematics

JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record 82|l22|-|-|H|2022



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Learning Outcomes

German contents and learning outcome available but not translated yet.

Wissenschaftliche Befähigung

- Die Absolventinnen und Absolventen sind vertraut mit den Arbeitsweisen und der zugehörigen Fachsprache der Mathematik und beherrschen die Methoden mathematischen Denkens und Beweisens.
- Die Absolventinnen und Absolventen besitzen grundlegende Kenntnisse der Numerischen Mathematik, der mathematischen Modellierung und des Wissenschaftlichen Rechnens und können sicher mit den Methoden umgehen.
- Die Absolventinnen und Absolventen besitzen grundlegende Kenntnisse weiterer Gebiete der Mathematik und sind vertraut mit den grundlegenden Beweismethoden dieser Gebiete.
- Die Absolventinnen und Absolventen kennen die grundlegenden Denkweisen und Arbeitstechniken eines weiteren Fachs aus dem Bereich der Naturwissenschaften und der Informatik.
- Die Absolventinnen und Absolventen sind geschult in analytischem Denken, besitzen ein hohes Abstraktionsvermögen, universell einsetzbare Problemlösungskompetenz und die Fähigkeit, komplexe Zusammenhänge zu strukturieren.
- Die Absolventinnen und Absolventen sind in der Lage, sich selbständig mithilfe von Fachliteratur in weitere Gebiete der Mathematik einzuarbeiten.
- Die Absolventinnen und Absolventen sind in der Lage, ihre Kenntnisse, Ideen und Problemlösungen verständlich zu präsentieren.
- Die Absolventinnen und Absolventen besitzen die für ein weiterführendes, insbesondere Master-Studium, erforderlichen Grundkenntnisse, Denk- und Arbeitsweisen und Methodenkenntnisse.
- Die Absolventinnen und Absolventen kennen die Regeln guter wissenschaftlicher Praxis und sind in der Lage, sie in ihrer eigenen Arbeit zu beachten.

Befähigung zur Aufnahme einer Erwerbstätigkeit

- Die Absolventinnen und Absolventen sind geschult in analytischem Denken, besitzen ein hohes Abstraktionsvermögen, universell einsetzbare Problemlösungskompetenz und die Fähigkeit, komplexe Zusammenhänge zu strukturieren.
- Die Absolventinnen und Absolventen sind in der Lage, ihre Kenntnisse, Ideen und Problemlösungen zielgruppenorientiert verständlich zu formulieren und zu präsentieren.
- Die Absolventinnen und Absolventen sind in der Lage, konkrete Probleme aus anderen Gebieten zu erkennen, zu strukturieren, zu modellieren und mit mathematischen Methoden Lösungswege zu entwickeln.
- Die Absolventinnen und Absolventen besitzen ein ausgeprägtes Durchhaltevermögen bei der Lösung komplexer Probleme.
- Die Absolventinnen und Absolventen sind in der Lage, konstruktiv und zielorientiert in Teams zu arbeiten.
- Die Absolventinnen und Absolventen sind in der Lage, sich weitere Wissensgebiete selbständig, effizient und systematisch zu erschließen.
- Die Absolventinnen und Absolventen sind vertraut mit mindestens einer modernen Programmiersprache und können sicher mit mathematischer Software umgehen.
- Die Absolventinnen und Absolventen besitzen die Fähigkeit, in interdisziplinär zusammengesetzten Teams im Bereich der Informatik und Naturwissenschaften gestaltend mitzuwirken.

Persönlichkeitsentwicklung

• Die Absolventinnen und Absolventen sind geschult in analytischem Denken, besitzen ein hohes Abstraktionsvermögen, universell einsetzbare Problemlösungskompetenz und die Fähigkeit, komplexe Zusammenhänge zu strukturieren.

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- Die Absolventinnen und Absolventen sind in der Lage, gesellschaftliche, wirtschaftliche und historische Entwicklungen und Prozesse kritisch zu reflektieren und zu bewerten.
- Die Absolventinnen und Absolventen sind in der Lage, in partizipativen Prozessen gestaltend mitzuwirken.
- Die Absolventinnen und Absolventen besitzen ein ausgeprägtes Durchhaltevermögen bei der Lösung komplexer Probleme.
- Die Absolventinnen und Absolventen sind in der Lage, Ideen und Lösungsvorschläge allgemeinverständlich zu formulieren und präsentieren.

Julius-Maxi

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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)):

29-Mar-2022 (2022-4)

22-Nov-2023 (2023-103)

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

(98 ECTS credits)



Subfield Mathematics

(73 ECTS credits)

Module title					Abbreviation
Overvie	Overview Analysis				10-M-ANA-Ü-222-m01
Module	e coord	inator		Module offered by	
Dean o	f Studio	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
13	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
2 seme	ster	undergraduate			
Conten	ts				
Real nu ries, dif with a f	imbers fferenti ocus o	and completeness, basic al and integral calculus i n functions in several var	c topological notions, n one variable, furthe riables.	, convergence and d r topological consid	ivergence of sequences and se- erations, differential calculus
Intende	ed learı	ning outcomes			
The stu them in lytic ba ten and	dent ki idepen ckgrou l oral fo	nows and masters the est dently, He/She has an ov nd and geometric interpr orm.	sential methods and verview over the fund etation, and can inte	proof techniques of amental notions and rconnect them and e	analysis and is able to apply d concepts of analysis, their ana- express them adequately in writ-
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) +	<u>v (4) +</u>	U (2)			
module is	creditab	le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
oral exa Assess Langua	aminati ment w ge of a	on of one candidate eacl ill have reference to the ssessment: German and,	h (20 to 40 minutes) contents of modules /or English	10-M-ANA1 and 10-N	I-ANA2.
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Workload					
390 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	e appea	irs in			
Bachel	Bachelor's degree (1 major) Mathematical Data Science (2022)				

Module title			Abbreviation		
Overvie	ew Line	ar Algebra			10-M-LNA-Ü-222-m01
Module	e coord	inator		Module offered by	
Dean o	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
13	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
2 seme	ster	undergraduate			
Conten	ts				
Basic n determ dan no	otions inants; rmal fo	and structures; vector sp eigenvalue theory; biline rm.	aces, linear maps an ear forms and Euclide	d systems of linear e ean/unitary vector sp	equations; theory of matrices and baces; diagonalisability and Jor-
Intende	ed learı	ning outcomes			
The stu ply then knows them a	dent ki m inde about t dequat	nows and masters the espendently. He/She has a heir algebraic and geomolely in written and oral for	sential methods and n overview over the fi etric background, is a m.	proof techniques of undamental notions able to relate them to	linear algebra and is able to ap- and methods of linear algebra, b each other and can present
$V(a) \pm b$	V (4) +				
Methoo module is	d of ass creditab	Sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
oral exa Assess Langua	aminati ment w ge of a	ion of one candidate each ill have reference to the o ssessment: German and,	h (20 to 40 minutes) contents of modules /or English	10-M-LNA1 and 10-M	-LNA2.
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Workload					
390 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	e appea	ins in			
Bachel	Bachelor's degree (1 major) Mathematical Data Science (2022)				

Module title			Abbreviation		
Stochastics 1			10-M-ST01-222-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 seme	ster	undergraduate			
Conten	ts				
Combin continu chastic varianc	iatorics ious dis indepe e, limit	s, Laplace models, select stributions: normal distri endence, elementary con theorems: law of large n	ed discrete distributi bution, random varia ditional probability, o umbers, central limit	ons, elementary mea ble, distribution fun- characteristics of dis theorem.	asure and integration theory, ction, product measures and sto- tributions: expected value and
Intende	ed learr	ning outcomes			
The stu practica	dent is al prob	acquainted with fundam lems and knows about th	ental concepts and r e typical fields of ap	nethods in stochasti plication.	cs, applies these methods to
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) +	Ü (2)				
Method module is	l of ass creditab	s essment (type, scope, langua ₎ le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
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 and/ bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes or English	chosen) or 6) or per candidate)	
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Workload					
300 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	Module appears in				
Bachelo	or's de	gree (1 major) Mathemati	cal Data Science (20:	22)	
exchan	exchange program Mathematics (2023)				

Module title			Abbreviation		
Numerical Mathematics 1			10-M-NUM1-222-m01		
Module coordinator				Module offered by	
Dean o	f Studio	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Solutio ons, in	n of sys terpola	stems of linear equations tion with polynomials, sp	and curve fitting pro plines and trigonome	blems, nonlinear eq tric functions, nume	uations and systems of equati- rical integration.
Intende	ed leari	ning outcomes			
The stu to prac	dent is tical pr	acquainted with the fun oblems and knows about	damental concepts a their typical fields o	nd methods in nume f application.	erical mathematics, applies them
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) +	Ü (2)				
Metho 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) written examination (approx. 90 to 180 minutes, usually chosen) or b) oral examination of one candidate each (15 to 30 minutes) or c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate) Language of assessment: German and/or English					
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Workload					
300 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachel	or's de	gree (1 major) Mathemati	cal Data Science (202	22)	
exchan	exchange program Mathematics (2023)				

Module title				Abbreviation	
Mather	Mathematical Foundations of Data Science			10-M-MFD-222-m01	
Module	e coord	inator		Module offered by	
Dean of	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
2 seme	ster	undergraduate			
Conten	ts				
calibrat for data compos ty, basi	tion, co a scient sition, c optin ed lear	orrelation, linear model an ce: orthogonality, matrix classification, approxima nization, linear and quad ning outcomes	nd generalized linear calculus, matrix facto tion and dimension r ratic programs, gradi	models, nonparame prisation, tensors, le reduction; Applied a ent descent, step siz	etric tests; Applied linear algebra ast squares, singular value de- nalysis for data science: convexi- ze tuning
The stu practica	dent is al prob	acquainted with the fundlems.	damental methods a	nd concepts of data	science and can apply them to
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) +	Ü (1) +	V (2) + Ü (1)			
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writte b) oral c) oral e Langua credital	en exai examir examin ge of a ble for	mination (approx. 90 to 1 nation of one candidate e nation in groups (groups c ssessment: German and, bonus	80 minutes, usually (ach (15 to 30 minutes of 2, 10 to 15 minutes /or English	chosen) or 6) or per candidate)	
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Workload					
300 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelo exchan	Bachelor's degree (1 major) Mathematical Data Science (2022) exchange program Mathematics (2023)				

Module title			Abbreviation			
Semina	Seminar Mathematics			10-M-SEM-152-m01		
Module	e coordi	nator		Module offered by		
Dean of	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	d of grading	Only after succ. com	pl. of module(s)		
5	numer	ical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	undergraduate				
Conten	ts					
A select	ted top	ic in mathematics.				
Intende	ed learn	ing outcomes				
The stu of a giv ly in a s	dent ga en topi scientifi	ins first experience with c using selected literatur c discussion.	independent scientif e, and prepares a tall	ic work. He/She main k on the subject. He,	sters elaboration and structuring /She is able to participate active-	
Courses	S (type, n	umber of weekly contact hours, la	anguage — if other than Ger	man)		
S (2)						
Method module is	d of ass creditabl	essment (type, scope, languag e for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk (60	to 120	minutes)				
Langua	ge of as	ssessment: German and/	or English			
Allocat	ion of p	laces				
	nalinf					
Additio	natinit	ormation				
Worklo	ad					
150 h	<u>au</u>					
Teachir	ng cycle	<u> </u>				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
§ 22 Nr. 3 f)						
Module appears in						
Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) First state examination for the teaching degree Gymnasium Mathematics (2015) First state examination for the teaching degree Gymnasium Mathematics (2019) Bachelor's degree (1 major) Mathematical Data Science (2022) exchange program Mathematics (2023) First state examination for the teaching degree Gymnasium Mathematics (2023) Bachelor's degree (1 major) Mathematics (2023)						

Module title					Abbreviation
Applied	l Stoch	astics Lab			10-M-APSL-222-m01
Module	e coord	inator		Module offered by	
Dean of	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Randor and cor	n numt nfidenc	per generators, Monte Ca e intervals, linear and log	rlo simulation, descri gistic regression, ana	ptive statistics, impl lysis of (co-)variance	lementation of tests, estimators e, data applications
Intende	ed learı	ning outcomes			
The stu ta and	dent is probler	acquainted with statistic ns and to adequately wo	cal software, e.g. R, a rk out and present de	ble to apply suitable eveloped solutions.	e statistical methods to given da-
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) +	P (2)				
Methoo module is	d 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
project Langua credital	work (ge of a ble for	30 to 60 hours) ssessment: German and, bonus	or English		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Workload					
180 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachel	or's de	gree (1 major) Mathemati	cal Data Science (20:	22)	
exchan	exchange program Mathematics (2023)				

Machine Learning and Numerics Lab Io-M-MLNL-222-m01 Module offered by Institute of Mathematics Dear of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s) 6 numerical grade Duration Module level Other prerequisites 1 undergraduate 1 sem ster undergraduate Intended in a nonlinear Systems of equations, gradient methods, Newton methods, step size selection, numerical optimization, optimization for machine learning (e.g. ADAM) Intended in acquainted with mathematical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical methods to machine learning problems and to adequately work out and present developed solutions. Conterstructiones Method of assessment (type, scope, language – if other than German) V (2) + P (2) Additional information Additional information Additional information Additional information Conterstruction Additional information Additional information regulations for teaching-degree programmes) <td< th=""><th colspan="3">Module title</th><th>Abbreviation</th></td<>	Module title			Abbreviation		
Module correlationModule offered byDearStathematik (Mathematics)Institute of MathematicsECTSMetrical gradingOnly after succ. compl. of module(s)6numerical gradeDurationModule levelOther prerequisites1 semesterundergraduateConterriationof linear and nonlinear Systems of equations, gradient methods, Newton methods, step sizeselection, numerical optimization, optimization for machine learning (e.g. ADAM)InterriationInterriationof discover and nonlinear systems of equations, gradient methods, nonlinear systems of acquately work out and present developed solutions.Correstinationsacquainted with mathematical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical methods to machine learning problems and to adequately work out and present developed solutions.Correstinationsacquainted with mathematical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical software, e.g. Mattable or bonusInstitute of Matter Softw	Machine Learning and Numerics Lab				10-M-MLNL-222-m01	
Dear of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Met→of grading Only after succ. compl. of module(s) 6 numerical grade Duration Module level Other prerequisites 1 semester undergraduate Contents mumerical solution of linear and nonlinear Systems of equations, gradient methods, Newton methods, step size selection, numerical optimization, optimization for machine learning (e.g. ADAM) Intended learning outcomes Institute of Mathematical Software, e.g. MATLAB, Python or Julia, able to apply suitable numerical methods to machine learning problems and to adequately work out and present developed solutions. Courses (type, number of weekly contact hours, language – if other than German) V (2) + P (2) Method of assessment (type, scope, language – if other than German, examination offered – if not every senester, information on whether module is creditable for bonus) project work (30 to 6 hours) Language of assessment: German and/or English creditable for bonus sectoreditable for bonus Sectoreditable for bonus Project work (30 to 6 hours) Sectoreditable for bonus Alditional information Sectoreditable for bonus sectoreditable for bonus Sectoreditable for bonus Morkicad Information sectoreditable fo	Module	coord	inator		Module offered by	
ECTS Meth→ of grading Only after succ. compl. of module(s) 6 num=rical grade Duratiom Module level Other prerequisites 1 semester undergraduate Contents Module level Other prerequisites Numerical solution of linear and nonlinear Systems of equations, gradient methods, Newton methods, step size selection, numerical optimization, optimization for machine learning (e.g. ADAM) Intended learning outcomes Image: Step selection and the mathematical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical methods to machine learning problems and to adequately work out and present developed solutions. Courses (type, number of weekly contact hours, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) Project work (30 to 60 hours) Language of assessment: German and/or English creditable for bonus) Image: Step set	Dean of	fStudie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
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Duration Module level Other prerequisites 1 semester undergraduate Contents Numerical solution of linear and nonlinear Systems of equations, gradient methods, Newton methods, step size selection, numerical optimization, optimization for machine learning (e.g. ADAM) Intended learning outcomes The student is acquainted with mathematical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical methods to machine learning problems and to adequately work out and present developed solutions. Courses (type, number of weekly contact hours, language – if other than German) V (2) + P (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) project work (30 to 60 hours) Language of assessment: German and/or English creditable for bonus Allocation of places 4dditional information Yorkload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	6	nume	rical grade			
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Contents Numerical solution of linear and nonlinear Systems of equations, gradient methods, Newton methods, step size selection, numerical optimization, optimization for machine learning (e.g. ADAM) Intended learning outcomes The student is acquainted with mathematical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical methods to machine learning problems and to adequately work out and present developed solutions. Courses (type, number of weekly contact hours, language – if other than German) V (z) + P (z) Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) project work (30 to 60 hours) Language of assessment: German and/or English creditable for bonus Allocation of places Additional information - Workload 180 h Teaching cycle Referred to in LPO I (examination for teaching-degree programmes)	1 seme	ster	undergraduate			
Numerical solution of linear and nonlinear Systems of equations, gradient methods, Newton methods, step size selection, numerical optimization, optimization for machine learning (e.g. ADAM) Intended learning outcomes The student is acquainted with mathematical software, e.g. MATLAB, Python or Julia, able to apply suitable nu- merical methods to machine learning problems and to adequately work out and present developed solutions. Courses (type, number of weekly contact hours, language – if other than German) V (2) + P (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) project work (30 to 60 hours) Language of assessment: German and/or English creditable for bonus Altocation of places Additional information Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	Conten	ts				
Intended learning outcomes The student is acquainted with mathematical software, e.g. MATLAB, Python or Julia, able to apply suitable numerical methods to machine learning problems and to adequately work out and present developed solutions. Courses (type, number of weekly contact hours, language – if other than German) V (2) + P (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) project work (30 to 60 hours) Language of assessment: German and/or English creditable for bonus Allocation of places Additional information Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	Numeri selectio	cal sol	ution of linear and nonlin nerical optimization, opti	ear Systems of equa mization for machine	tions, gradient meth learning (e.g. ADAN	ods, Newton methods, step size I)
The student is acquainted with mathematical software, e.g. MATLAB, Python or Julia, able to apply suitable nu- merical methods to machine learning problems and to adequately work out and present developed solutions. Courses (type, number of weekly contact hours, language – if other than German) V (2) + P (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) project work (30 to 60 hours) Language of assessment: German and/or English creditable for bonus Allocation of places Additional information Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	Intende	ed leari	ning outcomes			
Courses (type, number of weekly contact hours, language – if other than German) V (2) + P (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) project work (30 to 60 hours) Language of assessment: German and/or English creditable for bonus Allocation of places Additional information Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	The stu merical	dent is metho	acquainted with mathen ds to machine learning p	natical software, e.g. problems and to adec	MATLAB, Python or J Juately work out and	ulia, able to apply suitable nu- present developed solutions.
V (2) + P (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) project work (30 to 60 hours) Language of assessment: German and/or English creditable for bonus Allocation of places Additional information Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus) project work (30 to 60 hours) Language of assessment: German and/or English creditable for bonus Allocation of places Additional information Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	V (2) +	P (2)				
project work (30 to 60 hours) Language of assessment: German and/or English creditable for bonus Allocation of places Additional information Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	Methoo module is	l of ass creditab	e essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
Allocation of places Additional information Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	project Langua credital	work (ge of a ble for	30 to 60 hours) ssessment: German and, bonus	or English		
Additional information Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	Allocat	ion of p	olaces			
Additional information Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)						
Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	Additio	nal inf	ormation			
Workload 180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)						
180 h Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	Worklo	ad				
Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes)	180 h					
 Referred to in LPO I (examination regulations for teaching-degree programmes)	Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)						
	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in						
Bachelor's degree (1 major) Mathematical Data Science (2022) exchange program Mathematics (2023)	Bachelo exchan	or's de ge prog	gree (1 major) Mathemati gram Mathematics (2023)	cal Data Science (20:)	22)	



Subfield Computer Science

(25 ECTS credits)

Module title					Abbreviation	
Algorit	Algorithms, AI and Data Science 1				10-I-AKIDS1-222-mc)1
Module	coord	inator		Module offered by		
Dean of	fStudie	es Informatik (Computer S	Science)	Institute of Comput	er Science	
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	undergraduate				
Conten	ts					
sics of a sets, st memory and qui bles (ar test pat Uninfor metahe optimiz on algo duction Intende Studen science state sp ve to im rithmic problem in the fit	Introduction to algorithms and algorithmic thinking, introduction to artificial intelligence and data science; ba- sics of algorithms (building blocks, determinism, functional vs. imperative paradigm); Core data structures (lists, sets, stack, queue, heap), together with basics of programming (in Python); Algorithmic complexity: time and memory complexity, growth of functions, asymptotic notation and "Big-O"; Sorting (bubble, insert, heap, merge and quick sort) and algorithms of order statistics; Advanced data structures with associated algorithms: Hash ta- bles (and hash functions), trees (binary search trees, red-black trees) and graphs (connected components, shor- test path, minimum spanning tree); algorithm design and recursion; dynamic programming; state space search: Uninformed (depth/width first search), heuristic (A* algorithm), adversarial (MiniMax, alpha-beta pruning) and metaheuristic search (genetic algorithm, ant colony optimization); Function optimization (convex vs. non-convex optimization, numerical optimization, numerical optimization with gradient descent) and constrained optimizati- on algorithms (linear and quadratic programming, branch-and-bound algorithm); learning from data: light intro- duction to machine learning (parametric and non-parametric classification models, clustering). Intended learning outcomes Students will acquire fundamental knowledge of algorithms and data structures used throughout computer science, with a particular focus on the fundamentals of artificial intelligence algorithms and data science (e.g. state space search or optimization). They will acquire both theoretical and practical knowledge (as they will ha- ve to implement most of the algorithms covered). They will be able to analyze practical problems from an algo- rithmic perspective, identify the nature of the problem and choose an optimal algorithmic approach to solve the paraheme. In this course, which theory will acquire basis algorithmic provaded to solve the will acquire basis algorithmic approach to solve					
Course	S (type, n	number of weekly contact hours, l	anguage — if other than Gei	rman)		
V (4) + I	Ü (2)					
Methoc module is	l of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, informati	ion on whether
written If annoi examin prox. 15 credital	examinunced ation o minut ble for	nation (approx. 60 to 120 by the lecturer at the beg of one candidate each (ap ces per candidate). bonus	minutes). inning of the course, pprox. 20 minutes) or	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				
Workload						
300 h						
Teaching cycle						
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	immes)		
Bachelor's (2022)	with 1 maj	ior Mathematical Data Science	JMU Würzburg • g cord Bachelor (18	enerated 19-Apr-2025 • exam o ECTS) Mathematical Data S	. reg. data re- cience - 2022	page 19 / 102

Module appears in

Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)

Module title A					Abbreviation	
Algorithms, AI and Data Science 2					10-I-AKIDS2-222-m01	
Module	coord	inator		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)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Buildin algorith mic stra duced. duction can be	g on th amic fo ategies A treat of sim addres	e introductory course "Al undations of computer so for solving fundamental ment of elementary prob ple statistical methods v sed.	gorithms, Al and Data cience and artificial ir problems, approache abilistic methods for vith which supervisec	a Science 1", this mo ntelligence. In additi es to logical reasonir modeling uncertaint I and unsupervised p	dule introduces the logical and on to dealing with basic algorith- ng in computer science are intro- ies forms the basis for the intro- problems of machine learning	
Intende	ed leari	ning outcomes				
Studen develog in comr tificial i mal app	ts mas o soluti non pr ntellige oroach	ter the logical and algorit ions for specific compute oblem-solving strategies ence. They know basic ap es for modeling uncertair	hmic fundamentals o r science problems u and have initial expe proaches for deriving nties and know how t	f computer science. sing an analytical ap rience of how these g logical conclusions hese are used in the	They are able to independently pproach. Students are proficient can be used in the context of ar- s, have an understanding of for- context of machine learning.	
Course	S (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)		
V (4) +	Ü (2)					
Methoo module is	l of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
written If annou examin prox. 15 credital	examinunced ation o minut ble for	nation (approx. 60 to 120 by the lecturer at the beg of one candidate each (ap tes per candidate). bonus	minutes). inning of the course, oprox. 20 minutes) or	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					
300 h						
Teachir	Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	appea	irs in				
Bachel	or's deg	gree (1 major) Mathemati	cal Data Science (202 tolligonso and Data C	22)		
Bachelo	or's de	gree (1 major) Artificial In	telligence and Data S	cience (2022)		
Bachelo	or's de	gree (1 major) Artificial In	telligence and Data S	cience (2024)		

Module title					Abbreviation
Data Science & Machine Learning					10-I-DSML-222-m01
Module	e coord	inator		Module offered by	
Dean o	fStudi	es Informatik (Computer	Science)	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Intende	ed learı	ning outcomes			
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) +	Ü (2)				
module is written If anno examin prox. 19 credita Allocat	examin examin unced nation o 5 minut ble for ion of p	le for bonus) nation (approx. 60 to 120 by the lecturer at the beg of one candidate each (ap res per candidate). bonus	p minutes). inning of the course, oprox. 20 minutes) or	the written examination an oral examination	tion may be replaced by an oral in groups of 2 candidates (ap-
Additio	onal info	ormation			
Worklo	ad				
150 h					
Teachi	ng cycl	e			
Referred to in LPO I (examination regulations for teaching-degree programmes)					
-					
Module appears in					
Bachel Bachel Bachel Bachel	Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)				



Compulsory Electives Linear Algebra

(5 ECTS credits)

Module title					Abbreviation
Linear /	Algebra	a 1			10-M-LNA1-222-m01
Module	coord	inator		Module offered by	
Dean of	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	(not) s	successfully completed			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Basic n termina	otions ants.	and structures; vector sp	aces, linear maps, sy	stems of linear equa	ations; theory of matrices and de-
Intende	ed lear	ning outcomes			
The stu ted with to perfo	dent ki n the co orm sin	nows and masters the ba entral proof methods in li 1ple mathematical argum	sic notions and esse near algebra and can ents independently,	ntial methods of line apply them to solve and can present the	ear algebra. He/She is acquain- e easy problems. He/She is able m adequately in written form.
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
Ü (2)					
Methoo module is	l of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
written exercise Langua	examiı es eacl ge of a	nation (approx. 90 to 180 1) ssessment: German and,	minutes) and writter /or English	n exercises (approx.	12 exercise sheets with approx. 4
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
150 h					
Teaching cycle					
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	ars in			
Bachelo	Bachelor's degree (1 major) Mathematical Data Science (2022)				

Module title					Abbreviation
Linear /	Algebra	12			10-M-LNA2-222-m01
Module	e coord	inator		Module offered by	
Dean of	f Studio	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	(not) s	successfully completed			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Eigenva	alue the	eory, bilinear forms, Eucli	dean and unitary vec	tor spaces, diagona	lisation and Jordan normal form.
Intende	ed leari	ning outcomes			
The stu ted with to perfo	dent ki h the co orm sin	nows and masters the ba entral proof methods in li pple mathematical argum	sic notions and essen near algebra and can ents independently,	ntial methods of line apply them to solve and can present the	ear algebra. He/She is acquain- e easy problems. He/She is able m adequately in written form.
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
Ü (2)					
Method 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 exercise Langua	examiı es eacł ge of a	nation (approx. 90 to 180 1) ssessment: German and,	minutes) and writter /or English	n exercises (approx.	12 exercise sheets with approx. 4
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
150 h					
Teaching cycle					
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				
Module	Module appears in				
Bachelo	Bachelor's degree (1 major) Mathematical Data Science (2022)				



Compulsory Electives Analysis

(5 ECTS credits)

Module title					Abbreviation
Analysi	is 1				10-M-ANA1-222-m01
Module	e coord	inator		Module offered by	
Dean o	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	(not) s	successfully completed			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Real nu ries; po one var	imbers ower se riable (l	and completeness; basic ries and Taylor series; ba Riemann integral and imp	c topological notions isics in differential ca proper integral).	; convergence and d lculus in one variab	ivergence of sequences and se- le; basics of integral calculus in
The stu central mather form.	dent kı proof r natical	nows and masters the est nethods in analysis and arguments independent	sential methods and can employ them to s ly and to express mat	notions of analysis. olve easy problems. hematical argument	He/She is acquainted with the He/she is able to perform easy s precisely and clearly in written
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
Ü (2)					
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
written exercis Langua	examin es each ge of a	nation (approx. 90 to 180 n) ssessment: German and,	minutes) and writter /or English	n exercises (approx.	12 exercise sheets with approx. 4
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
150 h					
Teaching cycle					
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	Module appears in				
Bachel	Bachelor's degree (1 major) Mathematical Data Science (2022)				

Module title					Abbreviation
Analysis	Analysis 2				10-M-ANA2-222-m01
Module	coordi	nator		Module offered by	
Dean of	Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	(not) s	uccessfully completed			
Duration	n	Module level	Other prerequisites		
1 semes	ter	undergraduate			
Content	S				
Further t implicit	topolo; functio	gical considerations, bas on theorem.	sics in differential cal	culus in several varia	ables, inverse function theorem,
Intende	d learr	ing outcomes			
The stuc central p mathem form.	dent kr proof n natical	nows and masters the est nethods in analysis and o arguments independentl	sential methods and can employ them to s ly and to express mat	notions of analysis. olve easy problems. hematical argument	He/She is acquainted with the He/she is able to perform easy s precisely and clearly in written
Courses	i (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
Ü (2)					
Method module is a	of ass	essment (type, scope, langua; le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
written e exercise Languag	examir es each ge of a	nation (approx. 90 to 180 1) ssessment: German and/	minutes) and writter /or English	n exercises (approx.	12 exercise sheets with approx. 4
Allocatio	on of p	laces			
	•				
Additior	nal info	ormation			
Workloa	ad				
150 h					
Teaching cycle					
Referred	Referred to in LPO I (examination regulations for teaching-degree programmes)				
Module	appea	rs in			
Bachelo	Bachelor's degree (1 major) Mathematical Data Science (2022)				



Compulsory Electives Mathematical Data Science

(40 ECTS credits)



Subfield Mathematics

(20 ECTS credits)

Module title Abbreviation					Abbreviation
Numeri	cal Ma	thematics 2			10-M-NUM2-222-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	undergraduate			
Conten	ts				
Eigenva bounda	alue pro ary valu	oblems, linear programm Je problems.	ing, methods for initi	al value problems fo	or ordinary differential equations,
Intende	ed leari	ning outcomes			
The stu about t and ens	dent is heir ad gineeri	able to draw a distinctio vantages and limitations ng sciences and economi	n between the differe concerning the poss ics.	ent concepts of nume ibilities of application	erical mathematics and knows on in different fields of natural
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) + (Ü (2)				
Method module is	l of ass creditab	s essment (type, scope, langua ₎ le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writte b) oral e c) oral e Langua credital	en exar examin examin ge of a ole for	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ssessment: German and/ bonus	80 minutes, usually (ach (15 to 30 minutes of 2, 10 to 15 minutes /or English	chosen) or 6) or per candidate)	
Allocati	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teaching cycle					
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	irs in			
Bachelo	or's de	gree (1 major) Mathemati	cal Data Science (20:	22)	
exchange program Mathematics (2023)					

Module title					Abbreviation	
Stochastics 2					10-M-STO2-222-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Elemen	ts of d	ata analysis, statistics of	data in normal and o	ther distributions, e	lements of multivariate statistics.	
Intende	ed lear	ning outcomes				
The stu tical pr	dent is oblems	acquainted with fundam and knows about the typ	iental concepts and r pical fields of applica	nethods in statistics tion.	, applies these methods to prac-	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
V (4) +	Ü (2)					
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writt	en exai	mination (approx. 90 to 1	80 minutes, usually	chosen) or		
c) oral	examin	ation in groups (groups of	of 2. 10 to 15 minutes	per candidate)		
Langua	ge of a	ssessment: German and	/or English			
credita	ble for	bonus				
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachi	Teaching cycle					
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	appea	nrs in				
Bachel	or's de	gree (1 major) Mathemati	cal Data Science (20:	22)		
exchange program Mathematics (2023)						

Module title					Abbreviation	
Optimization for Machine Learning 10-M-OML					10-M-OML-222-m01	L
Module coordinator Module offered by				Module offered by	<u>,</u>	
Dean o	f Studi	es Mathematik (Mather	matics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	n		Other prerequisites			
	stor	undorgraduato				
1 Sellie		undergraduate				
Conten	ls					4 .
learnin	g probl	ems such as support v	ector machines.	ization, first order m	ethous, application	to machine
Intende	ed lear	ning outcomes				
The stu tical m	ıdent is achine	acquainted with the re learning problems, bot	elevant methods in optiche the optical sector is the oretically and nur	imization and is able nerically.	e to apply these meth	nods to prac-
Course	S (type, r	number 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	d of ass	sessment (type, scope, lang	uage — if other than German,	examination offered — if no	ot every semester, informati	on on whether
module is	s creditab	le for bonus)				
b) oral c) oral Langua Assess credita	examir examin ige of a ment o ble for	aation of one candidate ation in groups (groups ssessment: German an ffered: In the semester bonus	e each (15 to 30 minutes) s of 2, 10 to 15 minutes id/or English in which the course is	s) or per candidate) offered and in the su	ubsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
200 h						
Teachi		•	_			
Teacini	ing cycl	6				
 Deferme						
Referre	a to in	LPOI (examination regulation	ons for teaching-degree progra	immes)		
		•				
Module	e appea	ars in				
Bachel	Bachelor's degree (1 major) Economathematics (2022)					
Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)						
exchange program Mathematics (2023)						
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)						
Bachelor's degree (1 major) Economathematics (2023)						
Bachel	Bachelor's degree (1 major) Mathematical Physics (2024)					
Master	's degr	ee (1 major) Physics Int	ernational (2024)			
Bachel	or's de	gree (1 major) Economa	athematics (2024)			
Bachel	or's de	gree (1 major) Artificial	Intelligence and Data S	Science (2024)		
Bachelor's (2022)	with 1 ma	jor Mathematical Data Science	JMU Würzburg • g cord Bachelor (18	enerated 19-Apr-2025 • exam o ECTS) Mathematical Data S	1. reg. data re- cience - 2022	page 33 / 102



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

Module title					Abbreviation
Mathematics of Machine Learning					10-M-MML-222-m01
Module	coord	inator		Module offered by	
Dean of	f Studie	es Mathematik (Mathema	itics)	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	undergraduate			
Conten	ts				
Basic a	nd adv	anced concepts and met	hods of machine lear	ning, in particular th	eir mathematical foundations.
Intende	ed learr	ning outcomes			
The stu ning.	dent kı	nows the basic mathema	tical concepts and m	ethods that are appl	ied in the field of machine lear-
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 Engli	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) writte b) oral c) oral Langua Assess credita	en exar examin examin ge of a ment o ble for	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ssessment: German and/ ffered: In the semester in bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes 'or English which the course is	chosen) or 5) or per candidate) offered and in the su	ıbsequent semester
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teaching cycle					
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				
Module	e appea	rs in			
Bachel	or's deg	gree (1 major) Mathemati	cal Data Science (202	22)	
exchange program Mathematics (2023)					

Module title					Abbreviation
Modelling and Computational Science					10-M-MWR-222-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	npl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Aspects scaling ons, fur near eq	s of ma the mo ndame juation	thematical modelling of t odelling, asymptotic serie ntal methods for numeric s.	technical or scientific es, classical methods al solution of partial	processes. Basic pr for solving ordinary differential equatior	inciples of modelling, aspects of and partial differential equati- ns and the resulting systems of li-
Intende	ed learr	ning outcomes			
The stu and eng	dent m gineerii	asters the fundamental r ng sciences on a comput	nathematical methoc er.	ls and techniques to	simulate processes from natural
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) + I Module	Ü (2) taugh	t in: German and/or Engl	ish		
Methoo 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
a) writte b) oral e c) oral e Langua Assessi credital	en exar examin examin ge of a ment o ble for l	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ssessment: German and, ffered: In the semester in bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes for English which the course is	chosen) or s) or per candidate) offered and in the su	ıbsequent semester
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Worklo	ad				
300 h					
Teachir	ng cyclo	e			
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				
Module	Module appears in				
Master' Bachelo exchan Bachelo Master'	Master's degree (1 major) Functional Materials (2022) Bachelor's degree (1 major) Mathematical Data Science (2022) exchange program Mathematics (2023) Bachelor's degree (1 major) Mathematical Physics (2024) Master's degree (1 major) Functional Materials (2025)				
Module title				Abbreviation	
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Advanced Analysis					10-M-VAN-222-m01
Module coordinator				Module offered by	
Dean of	f Studie	es Mathematik (Mathema	tics)	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	undergraduate			
Conten	ts				
Continu rems.	uation o	of analysis in several vari	ables; Lebesgue mea	sure and Lebesgue	integral in R^n, integral theo-
Intende	ed learı	ning outcomes			
The stu she is a	dent is able to	acquainted with advance understand the construct	ed topics in analysis. ion of a complex mat	Taking the example thematical concept.	e of the Lesbegue integral, he or
Course	S (type, n	umber of weekly contact hours, la	anguage — if other than Ger	man)	
V (4) +	Ü (2)				
Methoo module is	d of ass creditab	essment (type, scope, languag le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
a) writte b) oral e c) oral e Langua credital	en exai examin examin ge of a ble for	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups o ssessment: German and/ bonus	80 minutes, usually o ach (15 to 30 minutes If 2, 10 to 15 minutes Yor English	chosen) or s) or per candidate)	
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teachir	ıg cycl	e			
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelo	or's de	gree (1 major) Mathemati	cal Data Science (202	22)	
exchan	ge prog	gram Mathematics (2023)			
Master'	's degr	ee (1 major) Quantum Eng	gineering (2024)		
Master	s degr	ee (1 major) Physics Inter	national (2024)		

Module title				Abbreviation		
Introduction to Algebra					10-M-ALG-222-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Fundan	nental	algebraic structures (grou	ups, rings, fields), Ga	lois theory.		
Intende	ed lear	ning outcomes				
The stu the cen	ident ki itral co	nows and masters the es ncepts in this field, and is	sential methods and s able to apply the fu	basic notions in algo ndamental proof me	ebra. He/She is acquainted with thods independently.	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
V (4) +	Ü (2)					
Method module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writt b) oral c) oral Langua credita	en exai examir examin ige of a ble for	mination (approx. 90 to 1 lation of one candidate e ation in groups (groups c ssessment: German and, bonus	80 minutes, usually of ach (15 to 30 minutes of 2, 10 to 15 minutes or English	chosen) or 5) or per candidate)		
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teaching cycle						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	Module appears in					
Bachel	or's de	gree (1 major) Mathemati	cal Data Science (202	22)		
exchange program Mathematics (2023)						

Module title					Abbreviation	
Introduction to Differential Geometry					10-M-DGE-222-m01	
Module	e coord	inator		Module offered by		
Dean of	fStudi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Curves surface of surfa mal sur	in R^n s in R^ aces; cu faces,	and R^3; Frenet equation 3; parametrisation of sur urvature; outlook to furthe submanifolds.	ns, Frenet–Serret frar faces, examples; fun er topics in differentia	ne, curvature and to damental forms (me al geometry, for exar	rsion of curves; 2-dimensional trics, normal vector fields); area nple covariant derivatives, mini-	
Intende	ed leari	ning outcomes				
The stu quainte dently.	dent ki ed with	nows and masters the es the central concepts in t	sential methods and his field, and is able t	basic notions in diff to apply the fundam	erential geometry. He/She is ac- ental proof methods indepen-	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (4) +	Ü (2)					
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 Assess credita	en exar examin examin ge of a ment o ble for	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ssessment: German and, ffered: In the semester in bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes or English which the course is	chosen) or s) or per candidate) offered and in the su	ıbsequent semester	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in					
Bachel	Bachelor's degree (1 major) Mathematical Data Science (2022)					
exchange program Mathematics (2023)						

Module title					Abbreviation
Ordina	ry Diffe	rential Equations			10-M-DGL-222-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 seme	ster	undergraduate			
Conten	ts				
on of co and uni dence o methoo rised as	on a so onstant iquene of solut Is, mat sympto	ts, exact equations) and provide solution in the solutions of solutions; Gronwall ions on initial values, lin rix exponential function; tic stability; Lypunov me	ethous for scalar din particular examples li lemma; extendability ear differential equat autonomous systems thods, first integrals.	ike Bernoulli, Riccati y of solutions, maxir ions, algebraic struc s; notion of stability;	i; initial value problem; existence nal solution; continuous depen- cture of solution spaces, solution ; stability of linear systems; linea-
Intende	ed learr	ning outcomes			
The stu equatio	dent is ons. He	acquainted with the fun- /she is able to apply the	damental concepts a se methods to practic	nd methods of the th al problems.	neory of ordinary differential
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) + I	Ü (2)				
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
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 and, bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes /or English	chosen) or 5) or per candidate)	
Allocati	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teaching cycle					
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				
Module	appea	ins in			
Bachelo	or's deg	gree (1 major) Mathemati	cal Data Science (202	22)	
exchan	exchange program Mathematics (2023)				

Module title				Abbreviation	
Introduction to Complex Analysis					10-M-FTH-222-m01
Module	coord	inator		Module offered by	
Dean of	fStudi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
formati comple Cauchy tation c and Vit	ons), c x analy integra of real i ali's th	rentiability, Cauchy-Riem omplex integration, Cauc vsis (in particular identity al theorem, isolated sing ntegrals, argument princi eorem), Riemann's mapp	ann differential equa hy's integral theorem theorem, maximum ularities and Laurent iple, Rouche's theore ing theorem.	n and Cauchy's integ principle, openness series, residue theo m), normal families	ps (in particular Mobius trans- tral formula, basic principles of priciple, Schwarz lemma), gneral rem and its applications (compu- (in particular Montel's theorem
Intende	ed learı	ning outcomes			
The stu apply tl	dent is 1ese m	acquainted with the fun ethods to practical probl	damental concepts a ems.	nd methods in comp	blex analysis. He/she is able to
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) +	Ü (2)				
Methoo module is	l of ass	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot 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 and, bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes /or English	chosen) or 5) or per candidate)	
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teaching cycle					
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				
Module	e appea	ars in			
Bachel	or's de	gree (1 major) Mathemati	cal Data Science (202	22)	
exchange program Mathematics (2023)					

Module title				Abbreviation		
Introduction to Projective Geometry				10-M-PGE-222-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	undergraduate				
Conten	ts					
Projecti jective	ve and spaces	affine planes, projective , dualities and polarities	and affine spaces, the of projective spaces.	neorem of Desargues	s, fundamental theorems for pro-	
Intende	ed leari	ning outcomes				
The stu apply th	dent is nese m	acquainted with the fun ethods to practical probl	damental concepts a ems.	nd methods of proje	ctive geometry. He/she is able to	
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (4) + l	Ü (2)					
Method module is	l of ass creditab	s essment (type, scope, langua ₎ le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
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 1 lation of one candidate e ation in groups (groups c ssessment: German and, ffered: In the semester in bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes or English which the course is	chosen) or s) or per candidate) offered and in the su	ıbsequent semester	
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teaching cycle						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	Module appears in					
Bachelo	or's deg	gree (1 major) Mathemati	cal Data Science (202	22)		
exchan	exchange program Mathematics (2023)					

Module title				Abbreviation		
Geometric Analysis				10-M-GAN-222-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	undergraduate				
Conten	ts					
Submai tial forn and its folds wi	nifolds ns and specia ith corr	of R^n and regular value exterior derivative; Stoke l cases Gauss' theorem a ners.	theorem; submanifo es' theorem for differe nd Green's theorem;	olds with and withou ential forms; Hodge s outlook on further to	t boundary; orientation; differen- star operator; Stokes' theorem opics like density or submani-	
Intende	ed learr	ning outcomes				
The stu apply th	dent is nese m	acquainted with the funder the standard ethods to practical problem in the standard ethods to practical problem in the standard ethods are standard ethods at the standard ethods at th	damental concepts a ems.	nd methods in geom	etric analysis. He/she is able to	
Courses	5 (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (4) + Ü	Ü (2)					
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 credital	en exar examin examin ge of a ole for	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ssessment: German and/ bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes 'or English	chosen) or 5) or per candidate)		
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h	300 h					
Teaching cycle						
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module	appea	in and the second se				
Bachelo	or's deg	gree (1 major) Mathemati	cal Data Science (202	22)		
exchan	exchange program Mathematics (2023)					

Module title				Abbreviation		
Introduction to Discrete Mathematics				10-M-DIM-222-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 seme	ster	undergraduate				
Conten	ts					
Technic error-cc	ques fro prrectin	om combinatorics, introd g codes.	uction to graph theor	y (including applicat	tions), cryptographic methods,	
Intende	ed leari	ning outcomes				
The stu levant p realises	dent is proof te s the so	acquainted with the fun- echniques, is able to app cope of applications of di	damental concepts a ly methods from num screte structures.	nd results in discrete ber theory and algel	e mathematics, masters the re- ora to discrete mathematics and	
Course	S (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)		
V (4) +	Ü (2)					
Methoc module is	l of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writte b) oral e c) oral e Langua credital	en exar examin examin ge of a ble for	mination (approx. 90 to 1 lation of one candidate e ation in groups (groups c ssessment: German and, bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes /or English	chosen) or 6) or per candidate)		
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teaching cycle						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	Module appears in					
Bachelo	or's de	gree (1 major) Mathemati	cal Data Science (202	22)		
exchange program Mathematics (2023)						

Module title				Abbreviation		
Introduction to Functional Analysis				10-M-FAN-222-m01		
Module	coord	inator		Module offered by		
Dean of	fStudi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Banach ty; linea ple, ope (extens glu theo thonorr theory o	ar oper en map ion the orem, a nal sys of com	s; function spaces (L^p s ators, fundamental theor pping theorem, closed gra corem, separation theore idjoint operator, closed r tems; compact sets and pact normal and self-adjo	spaces of continuous rems for linear operat aph theorem; linear fu m), double dual spac ange theorem; Hilber operators, Arzela-Asco pint operators in Hilber	runctions, Sobolev s ors; Baire's theorem unctionals and dual e and reflexivity; we t spaces: Fréchet-Rie coli theorem; spectra ert spaces.	spaces), denseness, separabili- , uniform boundedness princi- spaces; Hahn-Banach theorem ak convergence, Banach-Alao- esz representation theorem, or- al theory: basic notions, spectral	
Intende	ed leari	ning outcomes				
The stu method broad a	dent kı ls, is al ıpplica	nows the fundamental co ole to apply methods fror bility of the theory to oth	ncepts and methods n linear algebra and a er branches of mathe	of functional analys analysis to functiona matics.	is as well as the pertinent proof al analysis, and realises the	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (4) +	Ü (2)					
Methoo 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	
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 and, bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes /or English	chosen) or 5) or per candidate)		
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h	300 h					
Teaching cycle						
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module	appea	in in in it is a second s		<u>```</u>		
Bachel	or's deg	gree (1 major) Mathemati	cal Data Science (20: \	22)		
exchange program mathematics (2023)						

Module title					Abbreviation	
Introduction to Partial Differential Equations					10-M-PAR-222-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	undergraduate				
Conten	ts					
Exampl transpo Dirichle near pa mula fo variable	es of p ort equa et probl rtial di or scala es, Fou	artial differential equatio ation, the Poisson equatio lems; energy methods, G fferential equations of fir r conservation laws; furth rier and Laplace transform	ns; existence and un on, the heat equatior reen's functions, may st order; Hopf-Lax for ner methods for solvi mation).	iqueness theorems; n and the wave equa kimum principle; exp mula for Hamilton-Ja ng partial differentia	exact solutions for the linear tion; boundary value problems, olicit solutions for general nonli- acobi equations; Lax-Oleinik for- Il equations (e.g., separation of	
Intende	ed learr	ning outcomes				
The stu tions. H	dent is Ie/she	acquainted with the func- is able to apply these me	damental concepts a ethods to practical pr	nd methods in the th oblems.	neory of partial differential equa-	
Courses	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (4) + l	Ü (2)					
Method module is	l of ass creditab	s essment (type, scope, langua; le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
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 1 ation of one candidate e ation in groups (groups c ssessment: German and/ ffered: In the semester in bonus	80 minutes, usually of ach (15 to 30 minutes of 2, 10 to 15 minutes /or English which the course is o	chosen) or 5) or per candidate) offered and in the su	ıbsequent semester	
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h	300 h					
Teaching cycle						
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module	Module appears in					
Bachelo exchan	Bachelor's degree (1 major) Mathematical Data Science (2022) exchange program Mathematics (2023)					

Module title					Abbreviation	
Introduction to Number Theory					10-M-ZTH-222-m01	
Module	e coord	inator		Module offered by		
Dean of	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Elemen tests ar forms, o	tary pr nd met diopha	operties of divisibility, pr hods for factorisation, str ntine approximation and	ime numbers and pri ructure of the residue diophantine equatio	me number factorisa class rings, theory o ons.	ation, modular arithmetics, prime of quadratic remainder, quadratic	
Intende	ed lear	ning outcomes				
The stu ploy the	dent is e basic	acquainted with the fun methods and proof tech	damental concepts a niques independentl	nd methods of numl y.	per theory. He/she is able to em-	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	rman)		
V (4) +	Ü (2)					
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether	
a) writte b) oral c) oral e Langua credital	en exai examir examin ge of a ble for	mination (approx. 90 to 1 nation of one candidate e ation in groups (groups c ssessment: German and, bonus	80 minutes, usually (ach (15 to 30 minutes of 2, 10 to 15 minutes /or English	chosen) or 5) or per candidate)		
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachir	Teaching cycle					
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	appea	in and a second s				
Bachel	or's de	gree (1 major) Mathemati	cal Data Science (20	22)		
exchan	ge prog	gram Mathematics (2023))			

Module title Abbreviation				Abbreviation	
Applied	l Algeb	ra			10-M-AAL-222-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 seme	ster	undergraduate			
Conten	ts				
Topics i theory, Applica	in field solvab itions o	theory (particularly algeb ility of equations, cycloto of algebra and number the	oraic field extensions omic fields, finite field eory (e.g., coding the	, ruler and compass ds). ory, cryptography, co	constructions, basics in Galois omputer algebra).
Intende	ed learr	ning outcomes			
The stu is acqu penden	dent kı ainted ıtly.	nows and masters the est with the central concepts	sential methods and s in this field, and is a	basic notions in algo able to apply the fun	ebra and its applications. He/She damental proof methods inde-
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) +	Ü (2)				
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
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 and/ bonus	80 minutes, usually (ach (15 to 30 minutes of 2, 10 to 15 minutes /or English	chosen) or 5) or per candidate)	
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Worklo	ad				
300 h					
Teachir	ng cycl	e			
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelo	or's deg	gree (1 major) Mathemati	cal Data Science (20:	22)	
exchan Bachelo	ge prog or's deg	gram Mathematics (2023) gree (1 major) Mathemati) cal Physics (2024)		

Module title				Abbreviation	
Introduction to Topology					10-M-TOP-222-m01
Module	e coord	inator		Module offered by	
Dean of	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Basics les and compac introdu	in set-t constr ctness, ction to	heoretic topology, topolo uctions of topological sp additional topics (optior algebraic topology.	ogical spaces and cor aces, quotients, conv al), e. g. the theorem	ntinuity, separation p vergence of sequenc is of Stone-Weierstra	properties, connectivity, examp- es and nets, different notions of aß, Arzela-Ascoli and Baire, and
Intende	ed learr	ning outcomes			
The stu is able theory t	dent kı to appl to othe	nows the fundamental co y methods from linear alg r branches of mathematio	ncepts and methods gebra and analysis to cs.	of topology as well a topology, and realis	as the pertinent proof methods, ses the broad applicability of the
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) +	Ü (2)				
Method 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) 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 1 ation of one candidate e ation in groups (groups c ssessment: German and/ ffered: In the semester in bonus	80 minutes, usually of ach (15 to 30 minutes of 2, 10 to 15 minutes for English which the course is a	chosen) or 5) or per candidate) offered and in the su	ıbsequent semester
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Worklo	ad				
150 h					
Teachir	Teaching cycle				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	rs in			
Bachelo	or's deg	gree (1 major) Mathemati	cal Data Science (202	22)	
exchan	exchange program Mathematics (2023)				

Module title			Abbreviation		
Introduction to Stochastic Financial Mathematics			10-M-EFM-222-m01		
Module coordinator Module offered b				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 seme	ster	undergraduate			
Conten	ts				
Arbitras term str of asse stochas	ge and ructure t pricin stic mu	no-arbitrage, annuities a s and yield curves, forwa g in the stochastic one-p lti-period models, valuat	nd bonds, valuation rds, payout profiles c eriod model, risk neu ion of European optic	of deterministic cash of options and other atral price measures, ons in the binomial n	n flows, actuarial present value, derivates, fundamental theorem replication and completeness, nodel, Black-Scholes formula.
Intende	ed leari	ning outcomes			
The stu apply th	dent is hem to	acquainted with the fund practical problems and k	damental concepts a nows about typical f	nd methods of stoch ields of application.	astic financial mathematics, can
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) +	Ü (2)				
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 and/ bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes /or English	:hosen) or 5) or per candidate)	
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teachir	ıg cycl	e			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	ars in			
Bachelo	or's deg	gree (1 major) Mathemati	cal Data Science (20:	22)	
exchange program Mathematics (2023)					

Module title				Abbreviation	
Introduction to Mathematical Logic					10-M-LOGP-232-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)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster				
Conten	ts				
Intende	ed lear	ning outcomes			
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
V (4) + Module	Ü (2) e taugh	t in: German and/or Engl	ish		
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writh b) oral c) oral Langua Assess credita	en exai examir examin ge of a ment o ble for	mination (approx. 90 to 1 nation of one candidate e ation in groups (groups o ssessment: German and, ffered: In the semester in bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes /or English which the course is	chosen) or 5) or per candidate) offered and in the su	ıbsequent semester
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teachir	ng cycl	e			
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)	
Module	e appea	ars in			
Bachel	or's de	gree (1 major) Mathemati	cal Data Science (20:	22)	
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2024)		
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)					



Subfield Computer Science

(ECTS credits)

Module title					Abbreviation
Softwa	re Tech	nology for Artificial Intel	ligence and Data Sci	ence	10-I-ST-KIDS-222-m01
Module	e coord	inator		Module offered by	
Dean o	f 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 seme	ster	undergraduate			
Conten	ts				
Intende	ed learı	ning outcomes			
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) +	Ü (2)				
Method module is	d of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
lf anno examin prox. 19 credita	unced ation o 5 minut ble for	by the lecturer at the beg of one candidate each (ap es per candidate). bonus	inning of the course, prox. 20 minutes) or	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					
Teachi	ng cycl	e			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	irs in			
Bachel	or's de	gree (1 major) Mathemati	cal Data Science (20:	22)	
Bachel	or's de	gree (1 major) Artificial In	telligence and Data S	cience (2022)	
Bachel	or's deg	gree (1 major) Artificial In	telligence and Data S	cience (2023)	
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)					

Module	Module title Abbreviation				
Practical Course in Programming for Mathematical Data Science				ience	10-I-PPM-222-m01
Module coordinator Mod			Module offered by		
Dean of	f Studio	es Informatik (Computer	Science)	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	(not) s	successfully completed		-	
Duratio	n	Module level	Other prerequisites		
1 seme:	ster		Intended learning of GdP. It is therefore s	utcomes of the follow trongly recommende	wing module are required: 10-l- ed to complete this before.
Conten	ts				
Intende	ed lear	ning outcomes			
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
P (6)					
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
practica minutes If annot examin prox. 15	al exam s) unced ation c 5 minut	nination (programming ex by the lecturer at the beg of one candidate each (ap res per candidate).	xercises, approx. 120 inning of the course, pprox. 20 minutes) or	hours) and written e the written examina an oral examination	examination (approx. 60 to 120 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	e			
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)	
Module	e appea	ars in			
Bachel	Bachelor's degree (1 major) Mathematical Data Science (2022)				

Module title			Abbreviation			
Databa	Databases 10-I-DB-152-m01					
Modul	e coord	inator		Module offered by	L	
Dean o	of Studi	es Informatik (Compute	er Science)	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	ester	undergraduate				
Conter	nts					
Relatio ment.	Relational algebra and complex SQL statements; database planning and normal forms; transaction manage-					
Intend	ed lear	ning outcomes				
The stu	udents	oossess knowledge ab	out database modellin	g and queries in SQL	as well as transaction	ons.
Course	es (type, r	umber of weekly contact hour	s. language — if other than Ge	rman)		
V (2) +	Ü (2)					
Metho module i	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
written If anno examir 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: German and/or English creditable for bonus					
Allocat	tion of j	olaces				
Additio	onal inf	ormation				
Worklo	pad					
150 h						
Teachi	ng cycl	e				
			_			
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	immes)		
§ 49 1	Nr. 1 b)					
8 09 11	NI. 1 D)					
Modul	e appea	irs in				
Bachel	lor's de lor's de	gree (1 major) Compute gree (1 major) Mathema	er Science (2015) atics (2015)	< >		
Bachel	Bachelor's degree (1 major) Business Information Systems (2015)					
Bachel	Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015)					
Bachel	Bachelor's degree (1 major) Aerospace computer Science (2015) Bachelor's degree (1 major) Functional Materials (2015)					
First st	ate exa	mination for the teachi	ng degree Realschule (Computer Science (2	015)	
First st	ate exa	mination for the teachi	ng degree Gymnasium	Computer Science (2	2015)	
Master	r's degr	ee (1 major) Physics (20	016)	(2016)		
Bachel	ior s ae Ior's de	gree (1 major) Business	s mormation Systems	(2010) 2017)		
				//		
Bachelor's (2022)	with 1 ma	jor Mathematical Data Science	JMU Würzburg • g cord Bachelor (18	enerated 19-Apr-2025 • exam o ECTS) Mathematical Data S	. reg. data re- cience - 2022	page 55 / 102

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Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Bachelor's degree (1 major) Business Information Systems (2019) Bachelor's degree (1 major) Business Information Systems (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Functional Materials (2021) Bachelor's degree (1 major) Computer Science und Sustainability (2021) Bachelor's degree (1 major) Business Information Systems (2021) Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Business Information Systems (2023) Bachelor's degree (1 major) Business Information Systems (2024) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024) Bachelor's degree (1 major) Functional Materials (2025) Bachelor's degree (1 major) Games Engineering (2025)

Module title			Abbreviation			
Fundar	nentals	of Programming			10-l-GdP-172-m01	
Module	e coord	inator		Module offered by		
holder	of the (Chair of Computer Scier	nce II	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
	nume	rical grade				
Duratio	name	Module level	Other prorequisites			
Duratio	stor	undergraduate				
1 Seine	ster	undergraduate				
Contents						
ject ori	ject orientation in Java, selected topics of C++, further Java concepts, digression: scripting languages.					
Intend	ed lear	ning outcomes				
The stu and are	udents e able t	oossess a fundamental o independently develo	knowledge about prog op average to high leve	gramming languages l Java programs.	(in particular Java, C	and C++)
Course	S (type, r	umber of weekly contact hours	, language — if other than Ge	rman)		
V (2) +	Ü (2)					
Metho	d of ass	essment (type, scope, lang	uage — if other than German.	examination offered — if no	ot every semester, informati	on on whether
module i	s creditab	le for bonus)	uugootiiei tiiuii ooiiiiuii,			
written If anno examir prox. 1 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). creditable for bonus					
Allocat	tion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cvcl	6				
Referre	ed to in	LPO I (examination regulation	ons for teaching-degree progra	immes)		
§ 49 N	Nr. 1 b)					
§6911	Vr. 1 b)					
Module	e appea	irs in				
Bachel	or's de	gree (1 major) Physics (2015)			
Bachel	or's de	gree (1 major) Aerospac	e Computer Science (2	2017)		
Bachel	or's de	gree (1 major) Compute	r Science (2017)			
Bachelor's degree (1 major) Computer Science (2019)						
Bachel	Bachelor's degree (1 major) Business Information Systems (2020)					
Bachel	ors de	gree (1 major) Physics (groo (1 major) Aprocing	2020) 20 Computer Science (c	1020)		
Bachel	or's de	gree (1 major) Aerospac	r Science und Sustain:	ability (2021)		
Bachel	or's de	gree (1 major) Business	Information Systems	(2021)		
Bachel	or's de	gree (1 major) Mathema	atical Data Science (20	22)		
Bachel	or's de	gree (1 major) Artificial	Intelligence and Data S	Science (2022)		
Bachelor's	with 1 ma	or Mathematical Data Science	JMU Würzburg • g	enerated 19-Apr-2025 • exam	. reg. data re-	page 57 / 102
(2022)			cord Bachelor (18	o ECTS) Mathematical Data S	cience - 2022	

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Business Information Systems (2023) Bachelor's degree (1 major) Business Information Systems (2024) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024) Bachelor's degree (1 major) Economathematics (2025)

Module title			Abbreviation			
Deep Lo	earning	5			10-l-DL-222-m01	
Module	coord	inator		Module offered by	Module offered by	
Dean of	fStudie	es Informatik (Computer	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 semester undergraduate						
Conten	ts					
The lec applica methoc field of retical f all the and tex	The lecture provides advanced knowledge of deep learning techniques such as FCN, CNN and LSTMs, practical application examples for NN architectures, e.g. in the field of image and speech processing. Current models and methods of machine learning and their technical background are presented. Building on this, models from the field of deep learning, such as CNNs, RNNs and sequence-to-sequence architectures, are discussed. The theoretical foundations of these models, such as training through backpropagation, are also discussed in detail. For all the models covered, it is shown how they are used in practice for specific problems such as image processing and text generation.					
Intende	ed learr	ning outcomes				
Studen res and res fron	ts have how tł n the lit	e knowledge of the possil ney are implemented in to terature, of data preparat	ole applications and l ools such as Tensorfl tion and of solving co	limitations of deep loow/Keras, of the abi ncrete tasks.	earning, of important architectu- lity to reprogram network structu-	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (2) +	Ü (2)					
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 anno examin prox. 15 credita	examir unced l ation o 5 minut ble for	nation (approx. 60 to 120 by the lecturer at the beg if one candidate each (ap res per candidate). bonus	minutes). inning of the course, oprox. 20 minutes) or	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	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
§ 22	Vr. 3 b)					
Module	appea	ars in				
Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024) Bachelor's degree (1 major) Games Engineering (2025)						
Dachelor 3 degree (1 major) Games Engineering (2025)						

Module title			Abbreviation			
Introduction into Human-Computer Interaction			10-l-MCS-191-m01			
Module	e coord	inator		Module offered by		
holder	of the (Chair of Computer Scie	nce IX	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	Contents					
Human-Computer Interaction studies the design, evaluation, and implementation of interactive computer sy- stems. Special focus lies on fundamental psychological and physiological properties of the human users, the technical principals and models of modern computer systems, as well as on the derived boundary conditions of designing usable and human-oriented interactions with technical systems. The topics of this course cover the human perception and cognition, the human memory and attention, the design of interactive systems, popuplar evaluation methods, principles of computer systems, input processing techniques, human interfaces and typical means of interaction, from text-based input methods over graphical user interfaces to multi-modal interfaces. Accompanying practical tasks convey to the students typical methods of requirement analysis, prototyping and evaluation. Intended learning outcomes After successfully completing this course, students have a fundamental understanding of human-computer inter- face design principles. They understand the possibilities and limitations of technology and user and the applica- tion.						
les.	S (type, r	umber of weekly contact hour	s, language — if other than Ger	man)		
V (3) +	U (1)					
Method module is	d of ass creditab	sessment (type, scope, lang le for bonus)	guage — if other than German, e	examination offered — if no	ot every semester, informat	on on whether
written If anno examin prox. 19 Langua credita	examin unced aation c 5 minut ge of a ble for	nation (approx. 120 mi by the lecturer at the b of one candidate each (res per candidate). ssessment: German ar bonus	nutes) eginning of the course, approx. 20 minutes) or nd/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				
Worklo	ad					
150 h						
Teachi	ng cycl	е				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	annea	irs in				
Bachel	Bachelor's degree (1 major) Computer Science (2019) Bachelor's degree (1 major) Business Information Systems (2020)					
Bachel	or's de	gree (1 major) Compute	er Science und Sustaina	ability (2021)		
Bachelor's (2022)	with 1 maj	or Mathematical Data Science	JMU Würzburg • ge cord Bachelor (180	enerated 19-Apr-2025 • exam D ECTS) Mathematical Data S	ı. reg. data re- cience - 2022	page 60 / 102

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Bachelor's degree (1 major) Business Information Systems (2021) Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Business Information Systems (2023)

Module title					Abbreviation	
Computer Vision 10-I-CV-222-m01						
Module	e coord	inator		Module offered by		
holder	of the (Chair of Computer Scienc	e IV	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duration Module level Other prerequisites						
1 seme	1 semester undergraduate					
Conten	ts					
This co the reco It show is cons turns to near fil proced the reco zed. A l	This course aims at offering a self-contained account of computer vision and its underlying concepts, including the recent use of deep learning. It starts with an overview of existing and emerging computer vision applications. It shows how image processing is entering multiple fields from our daily life. First, the light-matter interaction is considered and the image acquisition cameras and illumination sources are also discussed. The course then turns to image representation and discretization, and describes pre-processing steps (such as linear and non-linear filters) used to enhance image quality and/or detect specific features. The course will continue by analyzing procedures to extract information from multiple images, with motion and 3D shape as major examples. Finally, the recognition of objects (specific and/or class level) will be discussed and different approaches will be analy-					s, including applications. iteraction course then ar and non-li- by analyzing les. Finally, vill be analy-
Intende	ed lear	ning outcomes				
U U U U U U U U U S	 Understanding of important computer vision concepts: light, matter, acquisition of images, color, texture, sampling, quantization, enhancement, feature extraction, segmentation, 3D acquisition, motion, tracking, object recognition. Understanding of deep learning (MLP, ConvNets, architectures) and the application to visual data. Deployment of vision and learning algorithms from standard libraries. Understanding of vision problems, and the ability to propose, debug, validate and explain solutions backet and explain solutions backet. 					color, tex- n, motion, Jata. lutions ba-
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (2) + Module	Ü (2) e taugh	t in: German and/or Engl	ish			
Methoo module is	d of ass s creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, informat	ion on whether
written If anno examin prox. 19 Langua credita	examin unced ation c 5 minut age of a ble for	nation (approx. 60 to 120 by the lecturer at the beg if one candidate each (ap res per candidate). ssessment: German and, bonus	minutes). inning of the course, pprox. 20 minutes) or /or English	the written examina an oral examination	tion may be replace in groups of 2 cand	d by an oral lidates (ap-
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
150 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
§ 22	Nr. <u>3</u> b)					
bachelor's	with 1 ma	or mathematical Data Science	JMU Würzburg • ge	enerated 19-Apr-2025 • exam	. reg. data re-	page 62 / 102

Module appears in

Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024) Bachelor's degree (1 major) Games Engineering (2025)

Module title				Abbreviation			
Natura	l Langu	age Processing			10-I-NLP-222-m01		
Module	e coord	inator		Module offered by	Module offered by		
holder	of the (Chair of Computer Scie	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	n	Module level	Other prerequisites				
1 semester undergraduate							
Contents							
text dat stemmi ons and Models nal sen embed networl lysis) ve tasks (e Intende	Introduction to Text Mining and Natural Language Processing; Traditional computational representations of text data (bag-of-words) and text preprocessing (sentence splitting, tokenization, morphological normalization, stemming); Corpus linguistics and lexical association measures (ngram frequencies, co-occurrences, collocations and terminology extraction); Syntactic analysis: Part-of-Speech tagging and chunking (with Hidden Markov Models and Conditional Random Fields), parsing (Probabilistic Context Free Grammars and parsers); Distributional semantics and latent text representations: distributional hypothesis, Latent Semantic Analysis (LSA), word embeddings; Light introduction to (modern) deep learning-based NLP: embeddings, convolutional and recurrent networks, Transformers. NLP Applications: text classification tasks (e.g., document classification, sentiment analysis) vs. token classification tasks (e.g., information extraction - named entity recognition) vs. text generation tasks (e.g. machine translation and text summarization).						
of text i knowle well as experie	mining dge: ar the ap	and natural language nalyze the text data for propriate (machine lea plementing solutions f	processing. They will be the task at hand, choo rning for NLP) model to for a wide range of com	e able to solve practi se the appropriate ro solve the task. They mon NLP tasks and a	ical problems with the presentation for the vill have gained ricapplications.	ne obtain Pir texts as h practical	
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)			
V (2) + Module	Ü (2) e taugh	t in: German and/or En	glish				
Method module is	d of ass creditab	sessment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether	
written If anno examin prox. 1 <u>9</u> Langua credita	examin unced ation of 5 minut ge of a ble for	nation (approx. 60 to 1: by the lecturer at the b of one candidate each (ces per candidate). ssessment: German ar bonus	20 minutes). eginning of the course, approx. 20 minutes) or nd/or English	the written examina an oral examinatior	tion may be replace i in groups of 2 cand	d by an oral idates (ap-	
Allocat	ion of J	olaces					
Additio	nal inf	ormation					
Worklo	ad						
150 h	150 h						
Teachi	ng cycl	e					
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)			
§ 22	Nr. 3 b)						
Module	e appea	ars in					
Bachelor's (2022)	with 1 ma	jor Mathematical Data Science	JMU Würzburg • g cord Bachelor (18	enerated 19-Apr-2025 • exam o ECTS) Mathematical Data S	n. reg. data re- cience - 2022	page 64 / 102	

Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024) Bachelor's degree (1 major) Games Engineering (2025)

Module	title				Abbreviation
Statisti	ical Net	work Analysis			10-I-SNA-222-m01
Module	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. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semester undergraduate					
Conten	ts				
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 analyse 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, 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					
Intende	ed learr	ning outcomes			
The cou ven mo titativel terns. P very lar derstan distribu dom pr	urse wil delling ly mode Particip ge netv iding o utions i ocesse	l equip participants with of complex technical, so el the topology of networ ants will learn how to use vorks that are generated f how the structure of net nfluence the robustness s.	statistical network and ocial, and biological s ked systems and how e analytical methods based on different st tworks shapes dynam of systems, and how	nalysis techniques t ystems. Students wi we can detect and to make statements ochastic models. Th ical 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	man)	
V (2) + Module	Ü (2) e taugh	t in: German and/or Engl	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
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					
Allocat	ion of p	olaces			
Additio	nal inf	ormation			

Workload

150 h

Teaching cycle

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

§ 22 II Nr. 3 b)

Module appears in

Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)

Module title					Abbreviation
Cognitive Systems					10-l-KogSys-222-m01
Module coordinator				Module offered by	
Dean o	f Studi	es Informatik (Computer S	Science)	ence) Institute of Computer Science	
ECTS	ECTS Method of grading		Only after succ. compl. of module(s)		
5	nume	rical grade			
Duration Module level		Other prerequisites			
1 semester undergraduate		undergraduate			
Conten	ts				
Intende	ed lear	ning outcomes			
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	man)	
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)					
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					
Additio	nal inf	ormation			
Workload					
150 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)					

Module title				Abbreviation		
Theory of Machine Learning					10-I-TML-222-m01	
Module coordinator				Module offered by		
Dean of Studies Informatik (Computer Science)			Science)	Institute of Computer Science		
ECTS	CTS Method of grading Only after suc			ompl. of module(s)		
5	nume	rical grade				
Duration Module level		Other prerequisites				
1 semester undergraduate						
Content	ts					
Intende	ed learr	ning outcomes				
Courses	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V (2) + Ü	Ü (2)	tin. Cormon and lar Engli	ich.			
Module	taugn	t in: German and/or Engli	isn			
module is	creditab	le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
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						
Allocati	ion of p	olaces				
Additional information						
Workload						
150 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
§ 22 ll Nr. 3 b)						
Module appears in						
Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024) Bachelor's degree (1 major) Games Engineering (2025)						

Module title					Abbreviation	
Selected Fundamentals of Artificial Intelligence and Data Science 1					10-I-AGKIDS1-222-m01	
Module coordinator				Module offered by		
Dean of Studies Informatik (Computer Science)			Science)	Institute of Computer Science		
ECTS	TS Method of grading Only after succ. compl. of module(s)					
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester undergraduate		undergraduate				
Conten	ts					
Selecte	ed topic	s in artificial intelligence	and data science			
Intende	ed lear	ning outcomes				
Students will be able to understand how to solve fundamental problems in artificial intelligence and data science and transfer them to related problems.						
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	rman)		
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)						
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						
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Workload						
150 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Bachelor's degree (1 major) Mathematical Data Science (2022)						
Bachel	Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)					
Bachel	Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)					
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)						

Module title					Abbreviation	
Selected Fundamentals of Artificial Intelligence and Data Science 2				10-I-AGKIDS2-222-m01		
Module coordinator				Module offered by		
Dean of Studies Informatik (Computer Science)			Science)	Institute of Computer Science		
ECTS	Metho	od of grading	Only after succ. compl. of module(s)			
5	5 numerical grade					
Duration Module level		Other prerequisites				
1 semester undergrad		undergraduate				
Conten	Contents					
Selecte	d topic	s in artificial intelligence	and data science			
Intende	ed lear	ning outcomes				
Studen science	ts will and tr	be able to understand ho ansfer them to related pr	w to solve fundamen oblems.	tal problems in artif	icial intelligence and data	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
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)						
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						
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
150 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Bachelor's degree (1 major) Mathematical Data Science (2022)						
Bachel	Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)					
Bachel	Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)					
Dachelor's degree (1 major) Antificial intelligence and Data Science (2024)						



Subfield Applications

(ECTS credits)
Module	title				Abbreviation
Applica	tions o	of Data Science in other o	lisciplines 1		10-M-ADS1-222-m01
Module	e coord	inator		Module offered by	
Dean of	fStudi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Applica	tions c	of mathematical data scie	ence in other disciplir	nes, e.g., in science,	humanities or economics.
Intende	ed learn	ning outcomes			
The stu studied	dent u I metho	nderstands the importan ods in an interdisciplinar	ce of mathematical d y context.	ata science for othe	r fields, and can apply the the
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) +	Ü (2)				
Methoo module is	d of ass creditab	eessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writte b) term c) oral e Langua	en exaı paper examin ge of a	nination (60 to 120 minu (15 to 30 pages) or ation of one candidate e ssessment: German and	ites) or ach (15 to 30 minutes /or English	;)	
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
150 h					
Teachir	ıg cycl	e			
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)	
Module	e appea	in and a second s			
Bachel	or's deg	gree (1 major) Mathemati	cal Data Science (20	22)	
exchan	exchange program Mathematics (2023)				

Module title				Abbreviation	
Applica	tions o	of Data Science in other o	lisciplines 2		10-M-ADS2-222-m01
Module	e coord	inator		Module offered by	
Dean of	f Studio	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Applica	tions c	f mathematical data scie	ence in other disciplir	nes, e.g., in science,	humanities or economics.
Intende	ed learn	ning outcomes			
The stu studied	dent u I metho	nderstands the importan ods in an interdisciplinar	ce of mathematical d y context.	ata science for othe	r fields, and can apply the the
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V (2) +	Ü (2)				
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
a) writte b) term c) oral e Langua	en exar paper examin ge of a	nination (60 to 120 minu (15 to 30 pages) or ation of one candidate e ssessment: German and	tes) or ach (15 to 30 minutes /or English	3)	
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
150 h					
Teachir	ıg cycl	e			
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)	
Module	e appea	in			
Bachel	or's deg	gree (1 major) Mathemati	cal Data Science (20	22)	
exchan	ge prog	gram Mathematics (2023)		



Key Skills Area (20 ECTS credits)



General Key Skills

(5 ECTS credits)

In addition to the modules listed below, students may also take modules offered by JMU as part of the pool of general transferable skills (ASQ).



General Key Skills (subject-specific)

(ECTS credits)

Module title Abbreviation						
Exercis	e tutor	or proof-reading in Math	nematics		10-M-TuKo-152-m01	
Module	e coord	inator		Module offered by		
Dean of	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	te	undergraduate				
Tutorin		ding homowork for one	fthe heric courses in	the Dechelaric art	a china daaraa nraa	****
der sup	ervisio	n of the respective lectur	er or exercise superv	isor.		rannies un-
Intende	ed lear	ning outcomes				
The stu mistake	dent is es in m	able to support the acqu athematical proof exercis	uisition of mathemations and to find possib	cal skills and knowle ble solutions.	edge. He/She helps t	o identify
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	man)		
Т (о)						
Methoo module is	d of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	xamination offered — if no	t every semester, informati	on on whether
Assess	ment o nits or	f tutoring activities or cor	recting work by supe	rvising lecturers or e	xercise supervisors	(1 to 2 tea-
	ion of r					
Allocal		Jaces				
Additio	nal inf	ormation				
Please	direct a	application to teaching co	ordinator Mathemat	ics, he/she will sele	ct participants.	
Worklo	ad	<u></u>				
150 h						
Teachir	ng cycl	9				
reaciiii	is cyci	6				
Referre	d to in	IPOI (examination regulation)	s for teaching-degree progra	mmes)		
§ 22	Vr. 3 f)					
Module	appea	urs in				
Bachel	or's de	gree (1 major) Mathemati	cs (2015)			
Bachel	or's de	gree (1 major) Economath	nematics (2015)			
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2015)			
Bachel	or's de	gree (1 major) Computatio	onal Mathematics (20	915)		
First sta	ate exa	mination for the teaching	degree Gymnasium	Mathematics (2015)		
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2016)			
Bachel	or's de	gree (1 major) Economath	nematics (2017)			
First sta	ate exa	mination for the teaching	degree Gymnasium	Mathematics (2019)		
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2020)			
Bachel	or's de	gree (1 major) Economath	rematics (2021)			
Bachel	or's de	gree (1 major) Economath	nematics (2022)			
Bachel	or's de	gree (1 major) Mathemati	cal Data Science (202	22)		
exchan	ge prog	gram Mathematics (2023))			
First sta	ate exa	mination for the teaching	degree Gymnasium	Mathematics (2023)		
Bachel	or's de	gree (1 major) Mathemati	cs (2023)			
Bachelor's (2022)	with 1 maj	or Mathematical Data Science	JMU Würzburg • ge cord Bachelor (180	nerated 19-Apr-2025 • exam ECTS) Mathematical Data So	. reg. data re- cience - 2022	page 78 / 102

Bachelor's degree (1 major) Economathematics (2023) Bachelor's degree (1 major) Mathematical Physics (2024) Bachelor's degree (1 major) Economathematics (2024) Bachelor's degree (1 major) Economathematics (2025)

Module title Abbreviation						
E-Learr	E-Learning and Blended Learning Mathematics 1			10-M-VHB1-152-mo:	1	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Meth	od of grading	Only after succ. com	pl. of module(s)		
2	(not)	successfully completed		•		
Duratio)n	Module level	Other prerequisites			
	stor	undergraduate				
Conton			[
Pocom	ing far	iliar with and reflecting t	ochniquos in o loarni	ng and blondod loar	ning in mathematics	
весот			echniques in e-leann	ng and blended lear	ning in mathematics).
Intend	ed lear	ning outcomes				
The stu	ident is	able to employ basic me	ethods of e-learning a	nd blended learning	; in mathematics-	
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
Ü (2)						
Course	type: e	Learning, mostly Virtuell	e Hochschule Bayern	(vhb)		
Metho module is	d of ass s creditab	sessment (type, scope, langua ole for bonus)	ge — if other than German, e	examination offered — if no	t every semester, informati	on on whether
project	(web-k	based, 15 to 20 hours)	ar comoctor			
Assess		inered: Once a year, white				
Allocat	ion of j	places				
Additio	onal inf	ormation	-			
Worklo	ad					
60 h						
Teachi	ng cycl	e				
Referre	d to in	IPOI (examination regulation)	s for teaching-degree progra	mmes)		
Modul		arc in				
Deahal		115 III 				
Bachel	ors de	gree (1 major) Mathemati groo (1 major) Economath	(2015)			
Bachel	or's de	gree (1 major) Leonomati gree (1 major) Mathemati	ical Physics (2015)			
Bachel	or's de	gree (1 major) Mathemati	onal Mathematics (20	015)		
Bachel	or's de	gree (1 major) Mathemati	ical Physics (2016)	5/		
Bachel	or's de	gree (1 major) Economath	nematics (2017)			
Bachel	or's de	gree (1 major) Mathemati	ical Physics (2020)			
Bachel	or's de	gree (1 major) Economath	nematics (2021)			
Bachel	Bachelor's degree (1 major) Economathematics (2022)					
Bachelor's degree (1 major) Mathematical Data Science (2022)						
exchan	ige pro	gram Mathematics (2023))			
Bachel	Bachelor's degree (1 major) Mathematics (2023)					
Bachel	or's de	gree (1 major) Economath	nematics (2023)			
Bachel	or's de	gree (1 major) Mathemati	ical Physics (2024)			
Bachel	or's de	gree (1 major) Economath	nematics (2024)			
васпеі	or s ae	gree (1 major) Economatr	iematics (2025)			
Bachelor's (2022)	with 1 ma	jor Mathematical Data Science	JMU Würzburg • ge cord Bachelor (180	enerated 19-Apr-2025 • exam () ECTS) Mathematical Data S	. reg. data re- cience - 2022	page 80 / 102

Module	e title				Abbreviation	
E-Learr	ning an	d Blended Learning Math	nematics 2		10-M-VHB2-152-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
2	(not)	successfully completed				
Duratio	n	Module level	Other prerequisites			
	ctor	undergraduate				
Conton	51C1	undergraduate				
Conten			<u>.</u> .		• • • •	
Becom	ing fam	niliar with and reflecting t	echniques in e-learni	ng and blended lear	ning in mathematics	•
Intende	ed lear	ning outcomes				
The stu	dent is	able to employ advance	d methods of e-learn	ing and blended lea	rning in mathematics	3-
Course	S (type, r	number of weekly contact hours, l	language — if other than Ger	man)		
Ü (2)	-					
Course	type: e	Learning, mostly Virtuell	e Hochschule Bayern	(vhb)		
Methoo module is	d of ass s creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, informati	on on whether
project	(web-b	based, 15 to 20 hours)				
Assess	ment o	ffered: Once a year, sum	mer semester			
Allocat	ion of _l	olaces				
Additio	nal inf	ormation				
WORKIO	au					
60 h						
Teachi	ng cycl	e				
			-			
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
Module	e appea	ars in				
Bachel	or's de	gree (1 major) Mathemati	ics (2015)			
Bachel	or's de	gree (1 major) Economath	nematics (2015)			
Bachel	or's de	gree (1 major) Mathemati	ical Physics (2015)			
Bachel	or's de	gree (1 major) Computati	onal Mathematics (20	015)		
Bachel	or's de	gree (1 major) Mathemati	ical Physics (2016)			
Bachel	or's de	gree (1 major) Economatł	nematics (2017)			
Bachel	or's de	gree (1 major) Mathemati	ical Physics (2020)			
Bachel	or's de	gree (1 major) Economatł	nematics (2021)			
Bachel	Bachelor's degree (1 major) Economathematics (2022)					
Bachel	Bachelor's degree (1 major) Mathematical Data Science (2022)					
exchan	ge prog	gram Mathematics (2023)			
Bachel	or's de	gree (1 major) Mathemati	ICS (2023)			
Bachel	orsde	gree (1 major) Economati	nematics (2023)			
Bachel		gree (1 major) Mathemati	ical PriySICS (2024)			
Bachel	or's de	gree (1 major) Economati	nematics (2024)			
Dachel	u sue		iematics (2025)			
Bachelor's (2022)	with 1 ma	Jor Mathematical Data Science	JMU Würzburg • ge cord Bachelor (180	enerated 19-Apr-2025 • exam o ECTS) Mathematical Data S	. reg. data re- cience - 2022	page 81 / 102



Subject-specific Key Skills

(15 ECTS credits)



Subject-specific Key Skills, Compulsory Courses

(11 ECTS credits)

Module title Abbreviation						
Basic N	lotions	and Methods of Mathe	ematical Reasoning		10-M-GBM-152-mo1	l
Module	e coord	inator		Module offered by	л	
Dean o	f Studi	es Mathematik (Mather	matics)	Institute of Mathem	natics	
ECTS	Meth	od of grading	Only after succ. con	pl. of module(s)		
2	(not)	successfully completed		•		
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conton	te	undergraduate				
Introdu	uction t	a the basis notions and		athomatics, approa	ch to coto formal los	ric and mana
Introdu			r proor techniques in m			sic allu illaps.
Intend	ed lear	ning outcomes				
The stu the Ba	ident g chelor's	ets acquainted with the s degree study program	e basic working technic me.	ues which are prere	quisites for the furth	er courses in
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V (1) +	Ü (1)					
Metho module is	d of ass s creditab	Sessment (type, scope, lang Ile for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
project	: (10 to	15 pages)				
Langua	age of a	ssessment: German an	d/or English			
Allocat	ion of	olaces				
Additio	onal inf	ormation				
Additic	onal inf	ormation on module du	uration: block taught pr	ior to the beginning	of the lecture period	
Worklo	ad				<u></u>	•
60 h						
Teachi						
Teacin	ing cyci	e				
Kererre		LPU I (examination regulation	ons for teaching-degree progra	immes)		
§ 22 § 22	Nr. 1 f) Nr. 2 f)					
Module	e appea	ars in				
Bachel	or's de	gree (1 major) Mathema	atics (2015)			
Bachel	or's de	gree (1 major) Economa	athematics (2015)			
Bachel	or's de	gree (1 major) Mathema	itional Mathematics (2015)	215)		
First st	ate exa	mination for the teachi	ng degree Grundschule	Mathematics (2015)	
First st	ate exa	mination for the teachi	ng degree Realschule I	Mathematics (2015))	
First st	ate exa	mination for the teachi	ng degree Mittelschule	Mathematics (2015))	
Bachel	Bachelor's degree (1 major) Mathematical Physics (2016)					
Bachel	Bachelor's degree (1 major) Economathematics (2017)					
First st 2015))	First state examination for the teaching degree Mittelschule Mathematics (2020 (Prüfungsordnungsversion 2015))				version	
Bachel	or's de	gree (1 major) Mathema	atical Physics (2020)			
Bachel	or's de	gree (1 major) Economa	athematics (2021)			
Bachel	or's de	gree (1 major) Economa	thematics (2022)			
Bachel	or's de	gree (1 major) Mathema	atical Data Science (20	22)		
Bachelor's (2022)	with 1 ma	jor Mathematical Data Science	JMU Würzburg • g cord Bachelor (18	enerated 19-Apr-2025 • exam o ECTS) Mathematical Data S	ı. reg. data re- cience - 2022	page 84 / 102



exchange program Mathematics (2023) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Economathematics (2023) Bachelor's degree (1 major) Mathematical Physics (2024) Bachelor's degree (1 major) Economathematics (2025)

Module title Abbreviation				Abbreviation		
Reason	ning an	d Writing in Mathemati	cs		10-M-ASM-152-m01	
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)		
2	(not) s	successfully completed		•		
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conton	te	undergraduate	1			
Introdu	uction to	- fundamental methods	of thinking and provis	a bacic tachniquae	in mathematics as y	well as ma
themat ductior	thematical writing; insight into examples of abstracts concepts in mathematics; approach to axiomatic and de- duction.					
Intende	ed lear	ning outcomes				
The stu form ea oral for	ident is asy mat m.	acquainted with the ba hematical arguments ir	nsic proof methods and adependently and pres	d techniques in math ent them adequately	nematics. He/She is y and reasonably in v	able to per- written and
Course	S (type, r	number of weekly contact hours	, language — if other than Ger	man)		
V (1) + (Ü (1)					
Methoo module is	d of ass s creditab	sessment (type, scope, langu le for bonus)	uage — if other than German, e	examination offered — if no	t every semester, informati	on on whether
project	(10 to	20 pages)				
Langua	ige of a	ssessment: German and	d/or English			
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
60 h						
Teachi	ng cycl	e				
		•	_			
Poforro	d to in	IPOL (ovamination regulation	nc for toaching dogroo progra	mmoc)		
				inites)		
Modula		are in				
Rachal	e appea	aroo (a major) Mathama	tics (2015)			
Bachel	or's de	gree (1 major) Mathema	thematics (2015)			
Bachel	or's de	gree (1 major) Leonoma gree (1 major) Mathema	tical Physics (2015)			
Bachel	or's de	gree (1 major) Computat	tional Mathematics (20	015)		
Bachel	or's de	gree (1 major) Mathema	tical Physics (2016)	5/		
Bachel	or's de	gree (1 major) Economa	thematics (2017)			
Bachel	Bachelor's degree (1 major) Mathematical Physics (2020)					
Bachel	or's de	gree (1 major) Economa	thematics (2021)			
Bachel	or's de	gree (1 major) Economa	thematics (2022)			
Bachel	or's de	gree (1 major) Mathema	tical Data Science (20:	22)		
exchan	ige prog	gram Mathematics (202	3)			
Bachel	or's de	gree (1 major) Mathema	tics (2023)			
		gree (1 major) Economa	inematics (2023)			
Bachelor's (2022)	with 1 ma	jor Mathematical Data Science	JMU Würzburg ● ge cord Bachelor (180	enerated 19-Apr-2025 • exam 5 ECTS) Mathematical Data S	. reg. data re- cience - 2022	page 86 / 102



Bachelor's degree (1 major) Mathematical Physics (2024) Bachelor's degree (1 major) Economathematics (2024) Bachelor's degree (1 major) Economathematics (2025)

Module	Module title				Abbreviation	
Externa	l Interi	nship Mathematical Data	Science		10-M-EPMDS-222-m01	
Module	coord	inator		Module offered by		
Dean of	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
7	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
The mo mather	dule co natical	onsists of a placement of data science and the sul	approximately six we osequent presentatio	eeks at a company o n of the placement r	r another organisation related to report.	
Intende	ed learr	ning outcomes				
The stu dies.	dent ha	as practical experience ir	the relevant fields a	nd is able to apply t	he skills obtained in his/her stu-	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
P (o)						
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	
placem	ent rep	ort (10 to 20 pages)	/or English			
Allocat	ion of r	laces				
	<u></u>					
Additio	nal info	ormation				
Worklo	ad					
210 h						
Teachir	ng cycl	9				
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)		
Module	e appea	rs in				
Bachel	or's deg	gree (1 major) Mathemati	cal Data Science (20:	22)		



Subject-specific Key Skills, Compulsory Electives

(4 ECTS credits)

Module title Abbreviation						
Compu	tationa	Il Mathematics			10-M-COM-152-m01	
Module	e coord	inator		Module offered by	ļ	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
4	(not)	successfully completed				
4 Duratio	<u>n</u>	Module level	Other prerequisites			
	stor	undorgraduato				
1 Seine	ster	undergraduate	[
Conten			<u> </u>		A (1) (1) AA (1)	
merical computation (e. g. Matlab) to supplement the basic modules in analysis and linear algebra (10-M-ANA-G and 10-M-LNA-G). Computer-based solution of problems in linear algebra, geometry, analysis, in particular diffe- rential and integral calculus; visualisation of functions.						
Intende	ed lear	ning outcomes				
The stu fields o	ident le of appli	earns the use of advanced cation to solve mathematics.	d modern mathematio tical problems.	cal software package	es, and is able to ass	sess their
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
V (1) +	Ü (2)					
Metho	d of ass	sessment (type, scope, langua	ge — if other than German, e	examination offered — if no	t every semester, informati	on on whether
project Langua	in the ge of a ment o	form of programming exe ssessment: German and, ffered: Once a year, wint	ercises (approx. 20 to /or English er semester	25 hours)		
Allocat	ion of I	places				
Additio	nal inf	ormation				
Worklo	ad					
120 h						
Teachi		0	-			
Teacini	ing cycl	c				
Referre		LPUT (examination regulation:	s for teaching-degree progra	mmes)		
<u>9</u> 22 II I	Nr. 3 f)	•				
Module	e appea	ars in				
Bachel	or's de	gree (1 major) Mathemati	ICS (2015)			
Bachel	or's de	gree (1 major) Physics (20	015) tura Tachnala <i>mi (</i> aasi	-)		
Bachel	or's de	gree (1 major) Nanostruct gree (1 major) Economath	amatics (2015)			
Bachol	or's de	gree (1 major) Economati gree (1 major) Mathemati	ical Physics (2015)			
Bachel	or's de	gree (1 major) Mathemati	onal Mathematics (20) 15)		
Bachel	or's de	gree (1 major) Functional	Materials (2015)	(51)		
First sta	ate exa	mination for the teaching	degree Gymnasium	Mathematics (2015)		
Bachel	or's de	gree (1 maior) Mathemati	ical Physics (2016)			
Bachel	or's de	gree (1 major) Economath	nematics (2017)			
First sta	ate exa	mination for the teaching	g degree Gymnasium	Mathematics (2010)		
Bachel	or's de	gree (1 major) Physics (20) () () ()	()		
Bachelor's	with 1 ma	jor Mathematical Data Science	JMU Würzburg ● ge	enerated 19-Apr-2025 • exam	. reg. data re-	page 90 / 102

Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major) Functional Materials (2021) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Economathematics (2022) Bachelor's degree (1 major) Economathematics (2022) Bachelor's degree (1 major) Mathematical Data Science (2022) exchange program Mathematics (2023) First state examination for the teaching degree Gymnasium Mathematics (2023) Bachelor's degree (1 major) Economathematics (2023) Bachelor's degree (1 major) Pinctional Materials (2024) Bachelor's degree (1 major) Functional Materials (2025) Bachelor's degree (1 major) Economathematics (2025)

Module	title				Abbreviation	
Progra	Programming course for students of Mathematics and other subjects			10-M-PRG-152-m01		
Module	coord	inator		Module offered by		
Dean of	fStudie	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
3	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
1 5000	stor	undergraduate				
Conton	tc	undergraduate				
Conten						
Basics	of a mo	dern programming langu	uage (e. g. C).			
Intende	ed learı	ning outcomes				
The stu in math	dent is Iematic	able to work independents.	ntly on small program	ming exercises and	standard programm	ing problems
Course	S (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)		
P (2)						
Methoo module is	l of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, informat	on on whether
project Langua	in the ge of a	form of programming exe ssessment: German and,	ercises (approx. 20 to /or English	25 hours)		
Assess	mento	ffered: Once a year, sum	mer semester			
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
90 h						
Teachir	ng cycl	۵				
reaciii	is cycl	6				
Deferre	d 4 a 1 a					
Kelelle		LFUT (examination regulation:	s for teaching-degree progra	mmes)		
Modula	<u>vi. 31)</u>					
Dechol	appea	IIS III araa (1 majar) Mathamati				
Bachel	ors deg	gree (1 major) Mathemati	CS (2015)			
Bachel	or's de	gree (1 major) Physics (20 gree (1 major) Nanostruct	ure Technology (2015	·)		
Bachel	or's de	gree (1 major) Ranostruct	amatics (2015)			
Bachel	nr's de	gree (1 major) Leonomati gree (1 major) Mathemati	cal Physics (2015)			
Bachel	nr's de	gree (1 major) Computati	onal Mathematics (20	15)		
Bachel	nr's de	gree (1 major) Eunctional	Materials (2015)	,1)		
First sta	ate exa	mination for the teaching	degree Gymnasium	Mathematics (2015)		
Bachel	Rachalor's degree (1 major) Mathematical Physics (2016)					
Bachel	Bachalor's degree (1 major) Mathematica (1951CS (2010) Bachalor's degree (1 major) Economathematics (2017)					
First sta	ate exa	mination for the teaching	degree Gymnasium	Mathematics (2010)		
Bachel	nr's de	gree (1 major) Physics (20	20)	mathematics (2019)		
Bachel	or's de	gree (1 major) Nanostruct	ture Technology (202))		
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2020)	-,		
Bachel	or's de	gree (1 major) Functional	Materials (2020)			
Bachelor's	with 1 maj	jor Mathematical Data Science	JMU Würzburg • ge	enerated 19-Apr-2025 • exam	. reg. data re-	page 92 / 102
(2022)			cord Bachelor (180	ECTS) Mathematical Data S	cience - 2022	

Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Economathematics (2021) Bachelor's degree (1 major) Economathematics (2022) Bachelor's degree (1 major) Mathematical Data Science (2022) exchange program Mathematics (2023) First state examination for the teaching degree Gymnasium Mathematics (2023) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Economathematics (2023) Bachelor's degree (1 major) Mathematical Physics (2024) Bachelor's degree (1 major) Economathematics (2024) Bachelor's degree (1 major) Functional Materials (2025) Bachelor's degree (1 major) Economathematics (2025)

Module	title				Abbreviation
Supple	mentai	ry Seminar Mathematics			10-M-SEM2-152-m01
Module	e coord	inator		Module offered by	
Dean of	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
4	(not) s	successfully completed			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
A select	ted top	ic in mathematics.			
Intende	ed leari	ning outcomes			
The stu of a giv ly in a s	dent ga en topi scientif	ains first experience with ic using selected literatur ic discussion.	independent scientil re, and prepares a tal	ic work. He/She ma k on the subject. He	sters elaboration and structuring /She is able to participate active-
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
S (2)					
Methoo module is	d of ass creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
talk (6c Langua	o to 120 ge of a	o minutes) ssessment: German and,	/or English		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
120 h					
Teachir	ıg cycl	e			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	ars in			
Bachelo	or's de	gree (1 major) Mathemati	cs (2015)		
Bachelo	or's de	gree (1 major) Mathemati	cal Physics (2015)		
Bachelo	or's de	gree (1 major) Computatio	onal Mathematics (20	015)	
Bachelo	or's de	gree (1 major) Mathemati	cal Physics (2016)		
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2020)		
Bachel	urs ae or's do	gree (1 major) Mathemati gree (1 major) Mathemati	cal Data Science (20)	22) 	
Bachelo	or's de	gree (1 major) Mathemati	cal Physics (2024)		

Module	Module title				Abbreviation	
Selecte	ed Topi	cs in History of Mather	natics		10-M-GES-152-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathe	natics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
5	(not) s	successfully completed		•		
Duratio	on (Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Historio the fun image	Historical and cultural development as well as social relevance of mathematics; more in-depth discussion of the fundamentals of mathematics, in particular in its relation to other sciences and humanities as well as to the image of mathematics in modern society.					
Intend	ed lear	ning outcomes				
Based tical th audien	on sele eories a ce.	ected examples, the stu and their social relevar	dent has gained insigh ice. He/she is able to p	t into the historical a resent mathematica	and cultural genesis l ideas and concepts	of mathema- to a general
Course	S (type, r	number of weekly contact hour	s, language — If other than Gei	man)		
V (2) +	U (2)					
module is	d Of ass s creditab	Sessment (type, scope, lang de for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informati	on on whether
c) proje Langua Assess Allocat	ect worl age of a ment o	k (15 to 25 hours) ssessment: German ar ffered: In the semester blaces	d/or English in which the course is	offered and in the su	ubsequent semester	
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	e				
		•				
Referre	d to in	IPOL (ovamination regulati	one for toaching dogroo progra	mmoc)		
δ 22	Nr 2 f)			inites)		
Module	e annea	ars in				
Bachel	or's de	gree (1 major) Mathem	atics (2015)			
Bachel	or's de	gree (1 major) Mathema	atical Physics (2015)			
Bachel	or's de	gree (1 major) Computa	itional Mathematics (20	015)		
First st	First state examination for the teaching degree Gymnasium Mathematics (2015)					
Bachel	Bachelor's degree (1 major) Mathematical Physics (2016)					
First st	ate exa	mination for the teaching	ng degree Gymnasium	Mathematics (2019)		
Bachel	or's de	gree (1 major) Mathema	aucal Physics (2020)	22)		
exchan	UISUE	gree (1 major) Mathematics (20)	ancai dala Science (20 Do)	2 <i>2)</i>		
First st	ate exa	mination for the teachi	ng degree Gymnasium	Mathematics (2023)		
			/	· ·		
Bachelor's (2022)	with 1 ma	Jor Mathematical Data Science	JMU Würzburg ● g cord Bachelor (18	enerated 19-Apr-2025 • exam D ECTS) Mathematical Data S	n reg. data re- cience - 2022	page 95 / 102



Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

Module title				Abbreviation			
Mathematical Writing				10-M-MSC-152-m01			
Module coordinator				Module offered by			
Dean of Studies Mathematik (Mathema		natics)	Institute of Mathem	natics			
ECTS Method of grading		Only after succ. compl. of module(s)					
5	(not)	successfully completed					
Duration Module level Other prerequisites							
1 semester undergraduate							
Conten							
Discus	sion of	good and bad mathema	atical writing using pra	ctical exercises and	case examples. The	course co-	
vers th	e whole	e range of mathematical	texts from short proo	fs and the formulation	on of theorems and d	lefinitions to	
compre	ehensiv	e works such as Bachel	or's or Master's these	s. Important aspects	include not only ma	thematical	
rigour a	and effi	ciency but also didactic	questions.				
Intende	ed lear	ning outcomes	_				
The stu	udent is the stru	able to formulate math ctures and conventions	ematical subject matt of mathematical litera	er precisely and com ature and the require	prehensibly. He/Shorements of scientific v	e knows vork.	
Course	es (type, r	number of weekly contact hours	 language — if other than Ge	rman)			
V (2) +	Ü (2)	,,,					
Metho	d of ass	sessment (type, scope, langu	lage — if other than German,	examination offered — if no	ot every semester, informati	ion on whether	
module is	s creditab	le for bonus)					
a) talk	(45 to 9	o minutes) or					
b) term	n paper	(10 to 15 pages) or					
c) proje	ect wor	K (15 to 25 hours)	d/or English				
Assess	sment o	ffered: In the semester i	in which the course is	offered and in the su	ubsequent semester		
Allocat	tion of p	olaces			·		
Additio	onal inf	ormation					
Worklo	bad						
150 h							
Teaching cycle							
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	ummes)			
§ 22	Nr. 3 f)						
Module appears in							
Bachelor's degree (1 major) Mathematics (2015)							
Bachelor's degree (1 major) Mathematical Physics (2015)							
Bachelor's degree (1 major) Computational Mathematics (2015)							
First state examination for the teaching degree Gymnasium Mathematics (2015)							
Bachelor's degree (1 major) Mathematical Physics (2016)							
First state examination for the teaching degree Gymnasium Mathematics (2019)							
Bachelor's degree (1 major) Mathematical Physics (2020)							
Bachel	ior's de	gree (1 major) Mathema	tical Data Science (20	22)			
First state examination for the teaching degree Gymnasium Mathematics (2023)							
Bachelor's (2022)	with 1 ma	or Mathematical Data Science	JMU Würzburg ● g cord Bachelor (18	enerated 19-Apr-2025 • exam o ECTS) Mathematical Data S	1. reg. data re- cience - 2022	page 97 / 102	



Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

Module title					Abbreviation			
School Mathematics from a Higher Perspective				10-M-SCH-152-m01				
Module coordinator				Module offered by				
Dean of Studies Mathematik (Mathema		matics)	cs) Institute of Mathematics					
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)				
5	(not) s	successfully completed	d					
Duration Module level Other prereq			Other prerequisites	equisites				
1 semester undergraduate								
Conten	Its							
Discus: their di	sion of idactic	selected topics in scho implementation at both	ol mathematics with re school and university	espect to their integr levels.	ation into wider theo	ories and		
Intende	ed lear	ning outcomes						
By means of selected examples, the student gains insight into the interrealtion between school mathematics and advanced mathematical theories. He/She is able to discuss these under mathematical, didactical and me-thodical aspect.								
Course	S (type, r	number of weekly contact hours	s, language — if other than Ger	man)				
V (2) +	Ü (2)							
Metho module is	d of ass s creditab	sessment (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	ot every semester, informati	on on whether		
b) term paper (10 to 15 pages) or c) project work (15 to 25 hours) Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester								
Allocat	ion of p	olaces						
Additio	onal inf	ormation						
Worklo	ad							
150 h								
Teaching cycle								
Referre	ed to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)				
§ 22 II Nr. 1 h)								
§ 22 II Nr. 2 I) § 22 II Nr. 3 f)								
Module appears in								
Bachelor's degree (1 major) Mathematics (2015)								
Bachelor's degree (1 major) Mathematical Physics (2015)								
Bachelor's degree (1 major) Computational Mathematics (2015)								
First state examination for the teaching degree Grundschule Mathematics (2015)								
First state examination for the teaching degree Gymnasium Mathematics (2015)								
First state examination for the teaching degree Mittelschule Mathematics (2015)								
Bachel	or's de	gree (1 major) Mathema	atical Physics (2016)					
First sta	First state examination for the teaching degree Gymnasium Mathematics (2019)							
Bachelor's (2022)	with 1 ma	jor Mathematical Data Science	JMU Würzburg ● g cord Bachelor (180	enerated 19-Apr-2025 • exam D ECTS) Mathematical Data S	i. reg. data re- cience - 2022	page 99 / 102		



First state examination for the teaching degree Mittelschule Mathematics (2020 (Prüfungsordnungsversion 2015))

Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major) Mathematical Data Science (2022) exchange program Mathematics (2023) First state examination for the teaching degree Gymnasium Mathematics (2023) Bachelor's degree (1 major) Mathematics (2023)

Bachelor's degree (1 major) Mathematical Physics (2024)



Thesis (12 ECTS credits)

Module title					Abbreviation	
Thesis Mathematical Data Science					10-M-BAD-222-m01	
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathema			atics)	s) Institute of Mathematics		
ECTS	Metho	Method of grading Only after succ. compl. of module(s)				
12 numerical grade						
Duratio	on	Module level	Other prerequisites			
1 semester		graduate	The supervisor may les that are relevant ment of the topic.	make the successful for the respective to	l completion of certain modu- pic a prerequisite for the assign-	
Conten	ts					
Indepe	ndently	<pre>/ researching and writing</pre>	on a topic in mathen	natics selected in co	nsultation with the supervisor.	
Intende	ed lear	ning outcomes				
The student is able to work independently on a given mathematical topic and apply the skills and methods ob- tained during his/her studies in the bachelor programme. He/She can write down the result of his/her work in a suitable form.						
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
No courses assigned 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)						
Bachelor's thesis (approx. 300 to 360 hours)						
Allocation of places						
Additional information						
Time to complete: 12 weeks						
Workload						
360 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in					
Bachelor's degree (1 major) Mathematical Data Science (2022)						