

Subdivided Module Catalogue for the Subject

Mathematical Physics

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

Examination regulations version: 2015 Responsible: Faculty of Mathematics and Computer Science Responsible: Institute of Mathematics Responsible: Faculty of Physics and Astronomy

JMU Würzburg • generated 18-Apr-2025 • exam. reg. data record 82|b55|-|-|H|2015

UNIVERSITÄT WÜRZBURG

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 Kenntnisse mathematischer Grundlagen der Theoretischen Physik und sind vertraut mit den grundlegenden Beweismethoden dieser Gebiete.
- Die Absolventinnen und Absolventen verstehen die mathematischen, theoretischen und experimentellen Grundlagen der Physik und können diese anwenden.
- Die Absolventinnen und Absolventen können unter Anleitung Experimente durchführen, analysieren und die erhaltenen Ergebnisse darstellen und bewerten.
- Die Absolventinnen und Absolventen sind in der Lage, physikalische Probleme durch Anwendung der wissenschaftlichen Arbeitsweise und unter Beachtung der Regeln guter wissenschaftlicher Praxis (Dokumentation, Fehleranalyse) zu bearbeiten.
- Die Absolventinnen und Absolventen verstehen die wesentlichen Zusammenhänge und Konzepte der einzelnen Teilgebiete der Theoretischen Physik.
- Die Absolventinnen und Absolventen sind in der Lage, ihre mathematischen Fähigkeiten auf physikalische Fragestellungen anzuwenden.
- 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 und Physik 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 in Mathematik und Physik, 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, auch in einer Fremdsprache zu formulieren und zu präsentieren.
- Die Absolventinnen und Absolventen sind in der Lage, konkrete Probleme zu erkennen, strukturieren und modellieren und mit mathematischen und physikalischen 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, sich weitere Wissensgebiete selbständig, effizient und systematisch zu erschließen.
- Die Absolventinnen und Absolventen sind in der Lage, konstruktiv und zielorientiert in einem heterogenen, interdisziplinären Team zusammenzuarbeiten, unterschiedliche und abweichen-

(2015) ta record Bachelor (180 ECTS) Mathematische Physik - 2015	Bachelor's with 1 major Mathematical Physics	JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-	page 2 / 118
	(2015)	ta record Bachelor (180 ECTS) Mathematische Physik - 2015	

de Ansichten produktiv zur Zielerreichung zu nutzen und auftretende Konflikte zu lösen (Teamfähigkeit).

• Die Absolventinnen und Absolventen sind in der Lage, Daten mit Hilfe von statistischen Methoden zu analysieren, zu interpretieren und darzustellen.

Persönlichkeitsentwicklung

UNIVERSITÄT

WÜRZBURG

- 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 kennen die Regeln guter wissenschaftlicher Praxis und sind in der Lage, sie in ihrer eigenen Arbeit zu beachten.
- 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 entwickeln die Bereitschaft und Fähigkeit, ihre Kompetenzen in partizipative Prozesse einzubringen und aktiv an Entscheidungen 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.

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)):

12-Aug-2015 (2015-80)

12-Jun-2024 (2024-74)

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.

Bachelor's with 1 major Mathematical Physics
(2015)

The subject is divided into

Abbreviation	Module title	ECTS credits	Method of grading	page
Compulsory Courses (110 E	CTS credits)			
Subfield Analysis (27 ECT	S credits)			
10-M-ANA1-152-m01	Analysis 1	8	B/NB	9
10-M-ANP-Ü-152-m01	Overview Analysis for Mathematical Physics	12	NUM	10
10-M-VAN-152-mo1 Advanced Analysis		7	NUM	68
Subfield Linear Algebra (a	20 ECTS credits)			
10-M-LNA1-152-m01	Linear Algebra 1	8	B/NB	46
10-M-LNP-Ü-152-m01	Overview Linear Algebra for Mathematical Physics	12	NUM	47
Subfield Classical Physic	s (16 ECTS credits)			
11-E-M-152-m01	Classical Physics 1 (Mechanics)	8	NUM	86
11-E-E-152-m01	Classical Physics 2 (Heat and Electromagnetism)	8	NUM	81
Subfield Theoretical Mec	hanics and Quantum Mechanics (16 ECTS credits)			
11-T-M-152-m01	Theoretical Mechanics	8	NUM	110
11-T-Q-152-m01	Quantum Mechanics	8	NUM	114
Subfield Statistical Physi				
11-T-SE-152-m01	Statistical Physics and Electrodynamics	6	NUM	117
Subfield Statistical Physi	cs and Electrodynamics II (10 ECTS credits)			
11-T-SA-152-m01	Statistical Physics - Exercises	5	NUM	116
11-T-EA-152-m01	Electrodynamics - Exercises	5	NUM	109
Subfield Laboratory Cours	se Physics (15 ECTS credits)			1
	Laboratory Course Physics A (Mechanics, Heat, Electromagne-	-		
11-P-PA-152-m01	tism)	3	B/NB	100
11-P-FR1-152-m01	Data and Error Analysis	2	B/NB	95
	Laboratory Course Physics B for Students of Mathematical Phy-			
11-P-MPB-152-m01	sics	4	B/NB	98
11-P-MPC-152-m01	Laboratory Course Physics C for Students of Mathematical Phy-	,	B/NB	
11-1-101	sics	4	D/ND	99
11-P-FR2-152-m01	Advanced and Computational Data Analysis	2	B/NB	97
Compulsory Electives Math	nematics (22 ECTS credits)			
Subgroup Basics of Math	ematical Methods (9 ECTS credits)			
10-M-DGE-152-m01	Introduction to Differential Geometry	9	B/NB	16
10-M-DGL-152-m01	Ordinary Differential Equations	9	B/NB	19
10-M-FTH-152-m01	Introduction to Complex Analysis	9	B/NB	32
10-M-GAN-152-m01	Geometric Analysis	9	B/NB	38
10-M-FAN-152-m01	Introduction to Functional Analysis	9	B/NB	27
10-M-PAR-152-m01	Introduction to Partial Differential Equations	9	B/NB	54
Subfield Overview Mathe	matical Methods (13 ECTS credits)			
10-M-DGGD-PÜ-152-m01	Overview Differential Geometry and Ordinary Differential Equa- tions for Mathematical Physics	13	NUM	18
10-M-FTDG-PÜ-152-m01	Overview Complex Analysis and Differential Geometry for Ma- thematical Physics	13	NUM	30

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11-E-O-152-m01	Optics and Waves	8	NUM	89
Module Group Experimen				
10-M-MWR-152-m01	Modeling and Computational Science	8	NUM	50
10-M-PARP-152-m01	Physics	10	NUM	55
10-M-FANP-152-m01	Introduction to Functional Analysis for Mathematical Physics	10	NUM	28
10-M-GANP-152-m01	Geometric Analysis for Mathematical Physics Introduction to Functional Analysis for Mathematical Physics	10	NUM	39
10-M-FTHP-152-m01	Introduction to Complex Analysis for Mathematical Physics	10	NUM	33
10-M-DGLP-152-m01	Ordinary Differential Equations for Mathematical Physics		NUM	20
10-M-DGEP-152-m01	Introduction to Differential Geometry for Mathematical Physics		NUM	17
10-M-ORSP-152-m01	Operations Research for Mathematical Physics	10 10	NUM	5
10-M-ZTHP-152-m01	Introduction to Number Theory for Mathematical Physics	10	NUM	7
10-M-PGEP-152-m01	Introduction to Projective Geometry for Mathematical Physics	10	NUM	50
10-M-DIMP-152-m01	Introduction to Discrete Mathematics for Mathematical Physics	10	NUM	2
10-M-ALGP-152-m01	Introduction to Algebra for Mathematical Physics	10	NUM	8
10-M-STO2P-152-mo1	Stochastics 2 for Mathematical Physics	10	NUM	6
10-M-STO1P-152-mo1	Stochastics 1 for Mathematical Physics	10	NUM	6
	Numerical Mathematics 2 for Mathematical Physics	10	NUM	5
-	Numerical Mathematics 1 for Mathematical Physics	10	NUM	5
	ntary Topics in Mathematics			1
Mathematical Physics (18				
for Mathematical Physics				
10-M-FAPA-PÜ-152-m01	for Mathematical Physics Overview Functional Analysis and Partial Differential Equations		NUM	20
10-M-GAPA-PÜ-152-m01	Overview Geometric Analysis and Partial Differential Equations		NUM	40
10-M-FTPA-PÜ-152-m01	Overview Complex Analysis and Partial Differential Equations for Mathematical Physics		NUM	34
10-M-GDPA-PÜ-152-m01	Overview Ordinary Differential Equations and Partial Differenti- al Equations for Mathematical Physics	13	NUM	4
10-M-DGPA-PÜ-152-m01	Overview Differential Geometry and Partial Differential Equati- ons for Mathematical Physics	13	NUM	2
10-M-FAGA-PÜ-152-m01	Overview Functional Analysis and Geometric Analysis for Ma- thematical Physics	13	NUM	2
10-M-FAFT-PÜ-152-m01	Overview Functional Analysis and Complex Analysis for Mathe- matical Physics	13	NUM	2.
10-M-FAGD-PÜ-152-m01	Overview Functional Analysis and Ordinary Differential Equati- ons for Mathematical Physics	13	NUM	2
10-M-FADG-PÜ-152-m01	Overview Functional Analysis and Differential Geometry for Ma- thematical Physics	13	NUM	2
10-M-GAFT-PÜ-152-m01	Overview Geometric Analysis and Complex Analysis for Mathe- matical Physics	13	NUM	3
10-M-GAGD-PÜ-152-m01	Overview Geometric Analysis and Ordinary Differential Equati- ons for Mathematical Physics	13	NUM	3
10-M-GADG-PÜ-152-m01	thematical Physics	13	NUM	3
10-M-FTGD-PÜ-152-m01	ons for Mathematical Physics	13	NUM	3

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11-E-A-152-m01	Atoms and Quanta	8	NUM	79
11-E-F-152-m01	Introduction to Solid State Physics	8	NUM	84
11-E-T-152-m01	Nuclear and Elementary Particle Physics	6	NUM	91
Module Group Suppleme	entary Topics in Physics		-	
11-GRT-152-m01	Group Theory	6	NUM	93
11-CP-152-m01	Computational Physics	6	NUM	77
11-SDC-152-m01	Statistics, Data Analysis and Computer Physics	4	NUM	106
11-AP-152-mo1 Astrophysics		6	NUM	72
11-TPS-152-m01	Particle Physics (Standard Model)	8	NUM	112
11-RTTB-232-mo1 Theory of Relativity		6	NUM	104
Module Group Current T	opics in Mathematical Physics			
11-BXMP5-152-m01	Current Topics in Mathematical Physics	5	NUM	74
11-BXMP6-152-mo1 Current Topics in Mathematical Physics		6	NUM	75
11-BXMP8-152-m01	Current Topics in Mathematical Physics	8	NUM	76
Key Skills Area (20 ECTS o	credits)			
transferable skills (ASQ) General Key Skills (sub		as part of t		
10-M-TuKo-152-mo1	Exercise tutor or proof-reading in Mathematics	5	B/NB	66
10-M-VHB1-152-m01	E-Learning and Blended Learning Mathematics 1	2	, B/NB	69
10-M-VHB2-152-m01	E-Learning and Blended Learning Mathematics 2	2	B/NB	70
11-P-VKM-152-m01	Preparatory Course Mathematics	2	B/NB	102
Subject-specific Key Skills (15 ECTS credits)		1	1 .	
Compulsory Courses (9	ECTS credits)			
10-M-GBM-152-m01	Basic Notions and Methods of Mathematical Reasoning	2	B/NB	41
10-M-ASM-152-m01	Reasoning and Writing in Mathematics	2	B/NB	11
11-SMP-152-m01	Seminar Mathematical Physics	5	B/NB	108
Subject-specific Key SI	kills, Compulsory Electives (6 ECTS credits)		I	
10-M-SEM2-152-m01	Supplementary Seminar Mathematics	4	B/NB	62
10-M-TOP-152-m01	Introduction to Topology	5	B/NB	65
10-M-COM-152-m01	Computational Mathematics	4	B/NB	14
10-M-PRG-152-m01 Programming course for students of Mathematics and other subjects		3	B/NB	57
10-M-GES-152-m01	Selected Topics in History of Mathematics	5	B/NB	44
10-M-MSC-152-m01	Mathematical Writing	5	B/NB	48
10-M-SCH-152-m01	School Mathematics from a Higher Perspective	5	B/NB	60
10-M-PRO-152-m01	Proseminar Mathematics	4	B/NB	59
11-M-MR-152-m01	Mathematical Methods of Physics	6	B/NB	94
11-CP-152-m01	Computational Physics	6	NUM	77
Thesis (10 ECTS credits)				
10-M-BAP-152-m01	Bachelor Thesis Mathematical Physics	10	NUM	13

Modul	e title				Abbreviation
Introdu	uction t	o Algebra for Mathemati	cal Physics		10-M-ALGP-152-m01
Module coordinator Module offered by					<u> </u>
		es Mathematik (Mathema	atics)	Institute of Mathen	natics
ECTS Method of grading Only after succ. compl. of module(s)					
10		rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ester	undergraduate			
Conter	nts				
Fundar	mental	algebraic structures (grou	ups, rings, fields), Ga	lois theory.	
		ning outcomes			
The stu	udent k				ebra. He/She is acquainted with thods independently.
		, number of weekly conta		•	. ,
V (4) +		, and of the weekly conta			,
b) oral c) oral Langua credita Allocat	examin examir age of a able for tion of		ach (15 to 30 minutes of 2, 10 to 15 minutes	s) or	
Worklo	oad				
300 h					
-	ing cycl	e			
-	ing cycl	e			
Teachi		e LPOI (examination regu	lations for teaching-o	degree programmes))
Teachi			lations for teaching-o	degree programmes))
Teachi Referre		LPOI (examination regu	lations for teaching-o	degree programmes))
Teachi Referre Module Bachel	ed to in e appea	LPOI (examination regu	cal Physics (2015)	degree programmes))

Module title Abbreviation						
Analysis 1 10-M-ANA1-152-m01						
Module	e coordinator			Module offered by		
Dean o	f Studies Mathematik (Ma	thematics)		Institute of Mathem	atics	
ECTS Method of grading Only after succ. compl. of module(s)						
8 (not) successfully completed						
Duration Module level Other prerequisites						
1 semester undergraduate						
Conten	ts					
ries; po		es; basics in diff	ferential ca		ivergence of sequences and se- le; basics of integral calculus in	
Intende	ed learning outcomes					
central	proof methods in analysis	s and can employ	y them to s	solve easy problems.	He/She is acquainted with the He/she is able to perform easy s precisely and clearly in written	
Course	s (type, number of weekly	contact hours, la	anguage –	- if other than Germa	n)	
V (4) +	Ü (2)					
ster, in written	formation on whether mod	dule can be chos	en to earn	a bonus)	tion offered — if not every seme- 12 exercise sheets with approx. 4	
Langua	ge of assessment: Germa	n and/or English				
Allocat	ion of places					
Additio	nal information					
Worklo	ad					
240 h						
	ng cycle					
	0.1/10					
Referre	ed to in LPO I (examinatio	n regulations for	teaching	legree programmec)		
Module appears in						
Bachel	or's degree (1 major) Math	ematics (2015)				
	or's degree (1 major) Econ					
	or's degree (1 major) Math					
	or's degree (1 major) Com			015)		
	or's degree (1 major) Math	•				
	or's degree (1 major) Econ		-			
	or's degree (1 major) Econ		2021)			
	ge program Mathematics	-				
Bachel	or's degree (1 major) Math	ematics (2023)				

	e title				Abbreviation
Overvi	ew Ana	lysis for Mathematical	Physics		10-M-ANP-Ü-152-m01
Module coordinator Module offere					<u> </u>
Dean c	of Studi	es Mathematik (Mathen	natics)	Institute of Mather	natics
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)	
12	nume	rical grade			
Duratio	on	Module level	Other prerequisites	6	
1 seme	ester	undergraduate			
Conter	nts				
ries, di	ifferent		in one variable, furth		livergence of sequences and se- derations, differential calculus
Intend	ed lear	ning outcomes			
them in lytic ba ten an	ndepen ackgrou d oral fo	idently, He/She has an ind and geometric inter orm.	overview over the func oretation, and can inte	damental notions an erconnect them and	f analysis and is able to apply d concepts of analysis, their ana express them adequately in writ
		, number of weekly con	tact hours, language –	– if other than Germa	an)
V (4) +	Ü (2)				
Metho	d of as				
		ion on whether module			ation offered — if not every seme
ster, in oral ex Assess	nformat aminat sment v		can be chosen to earn ch (20 to 40 minutes) e contents of modules	i a bonus)	ation offered — if not every seme M-ANP-Ü.
ster, in oral ex Assess Langua	nformat aminat sment v	ion on whether module ion of one candidate ea vill have reference to the assessment: German an	can be chosen to earn ch (20 to 40 minutes) e contents of modules	i a bonus)	
ster, in oral ex Assess Langua	nformat aminat sment v age of a	ion on whether module ion of one candidate ea vill have reference to the assessment: German an	can be chosen to earn ch (20 to 40 minutes) e contents of modules	i a bonus)	
ster, in oral ex Assess Langua Allocat	nformat aminat sment v age of a tion of [ion on whether module ion of one candidate ea vill have reference to the assessment: German an	can be chosen to earn ch (20 to 40 minutes) e contents of modules	i a bonus)	
ster, in oral ex Assess Langua Allocat	nformat aminat sment v age of a tion of [ion on whether module ion of one candidate ea vill have reference to the issessment: German an places	can be chosen to earn ch (20 to 40 minutes) e contents of modules	i a bonus)	
ster, in oral ex Assess Langua Allocat	aformat aminat sment v age of a tion of p onal inf	ion on whether module ion of one candidate ea vill have reference to the issessment: German an places	can be chosen to earn ch (20 to 40 minutes) e contents of modules	i a bonus)	
ster, in oral ex Assess Langua Allocat Additio Worklo	aformat aminat sment v age of a tion of p onal inf	ion on whether module ion of one candidate ea vill have reference to the issessment: German an places	can be chosen to earn ch (20 to 40 minutes) e contents of modules	i a bonus)	
ster, in oral ex Assess Langua Allocat Additio Worklo 360 h	nformat aminat sment v age of a tion of onal inf	ion on whether module ion of one candidate ea vill have reference to the assessment: German an places formation	can be chosen to earn ch (20 to 40 minutes) e contents of modules	i a bonus)	
ster, in oral ex Assess Langua Allocat Additio Worklo 360 h	aformat aminat sment v age of a tion of p onal inf	ion on whether module ion of one candidate ea vill have reference to the assessment: German an places formation	can be chosen to earn ch (20 to 40 minutes) e contents of modules	i a bonus)	
ster, in oral ex Assess Langua Allocat Additio 360 h Teachi 	nformat aminat sment v age of a tion of onal inf oad	ion on whether module ion of one candidate ea vill have reference to the assessment: German an places formation	can be chosen to earn ch (20 to 40 minutes) e contents of modules d/or English	a bonus) 10-M-ANA-1 and 10-	M-ANP-Ü.
ster, in oral ex Assess Langua Allocat Additio 360 h Teachi 	nformat aminat sment v age of a tion of onal inf oad	ion on whether module ion of one candidate ea vill have reference to the assessment: German an places formation	can be chosen to earn ch (20 to 40 minutes) e contents of modules d/or English	a bonus) 10-M-ANA-1 and 10-	M-ANP-Ü.
ster, in oral ex Assess Langua Allocat Additio 360 h Teachi Referro	nformat aminat sment v age of a tion of onal inf oad	ion on whether module ion of one candidate ea vill have reference to the assessment: German an places formation	can be chosen to earn ch (20 to 40 minutes) e contents of modules d/or English	a bonus) 10-M-ANA-1 and 10-	M-ANP-Ü.
ster, in oral ex Assess Langua Allocat Additio Worklo 360 h Teachi Referro Modul	aformat aminat sment v age of a tion of p onal inf onal inf oad ed to in e appea	ion on whether module ion of one candidate ea vill have reference to the assessment: German an places formation	can be chosen to earn ch (20 to 40 minutes) e contents of modules d/or English	a bonus) 10-M-ANA-1 and 10-	M-ANP-Ü.

Module t	itle			Abbreviation		
Reasoning and Writing in Mathematics 10-M-ASM-152-m01						
	oordinator		Module offered by			
Dean of Studies Mathematik (Mathematics) Institute of Mathematics						
ECTS Method of grading Only after succ. compl. of module(s)						
2 (not) successfully completed					
Duration	Module level	Other prerequisites				
1 semest	er undergraduate					
Contents						
	ion to fundamental methods al writing;insight into exampl					
Intended	learning outcomes					
	ent is acquainted with the ba y mathematical arguments in					
Courses	(type, number of weekly cont	act hours, language —	if other than Germa	n)		
V (1) + Ü	(1)					
	of assessment (type, scope, l rmation on whether module of			tion offered — if not	every seme-	
project (1	o to 20 pages) e of assessment: German and					
Allocatio	n of places					
Addition	al information					
Workload	1					
60 h						
Teaching	cycle					
	•					
Referred	to in LPO I (examination reg	lations for teaching-	legree programmes)			
Referred						
Madulaa						
	ppears in	• ()				
Bachelor's degree (1 major) Mathematics (2015)						
Bachelor's degree (1 major) Economathematics (2015)						
Bachelor's degree (1 major) Mathematical Physics (2015)						
Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Mathematical Physics (2016)						
Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Economathematics (2017)						
Bachelor's degree (1 major) Economathematics (2017) Bachelor's degree (1 major) Mathematical Physics (2020)						
Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major) Economathematics (2021)						
Bachelor's degree (1 major) Economathematics (2021) Bachelor's degree (1 major) Economathematics (2022)						
Bachelor's degree (1 major) Economathematics (2022) Bachelor's degree (1 major) Mathematical Data Science (2022)						
	e program Mathematics (202					
-	's degree (1 major) Mathemat					
	's degree (1 major) Economat					
	's degree (1 major) Mathemat					
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Bachelor's degree (1 major) Economathematics (2024) Bachelor's degree (1 major) Economathematics (2025)

Modul					Abbreviation
Bachelor Thesis Mathematical Physics 10-M-BAP-152-mo1					
Module coordinator Module offered by					
Dean c	of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS Method of grading Only after succ. compl. of module(s)					
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 semesterundergraduateWhere applicable, topic-specific modules as specified by supervisor.					
Conter	nts				
		y researching and writing ation with the supervisor		erdisciplinary) topic	in mathematics or physics selec-
Intend	ed lear	ning outcomes			
and ap	ply the				topic in mathematics or physics e can write down the result of
Course	es (type	, number of weekly conta	ict hours, language –	- if other than Germa	an)
No cou	irses as	signed to module			
		sessment (type, scope, la ion on whether module ca			ation offered — if not every seme-
written	thesis	(approx. 250 to 300 hou	rs total)		
Allocat	tion of	places			
Additio	onal inf	ormation			
Time to	o comp	lete: 10 weeks.	<u>.</u>		
Worklo					
300 h					
-	ng cycl	e			
			-		
Referre	ed to in	LPOI (examination regu	lations for teaching-o	degree programmes)	
Modul	e appe	ars in			
Bachel	lor's de	gree (1 major) Mathemati	ical Physics (2015)		
		gree (1 major) Mathemati			
		gree (1 major) Mathemati			
Bachel	lor's de	gree (1 major) Mathemati	ical Physics (2024)		

Module title Abbreviation						
Computational Mathematics 10-M-COM-152-mo1						
Modul	e coord	inator		Module offered by		
		es Mathematik (Mathem	atics)	Institute of Mathem		
ECTS			-		Iducs	
		od of grading successfully completed	Only after succ. con			
4	1	, ,				
Duration 1 seme		Module level undergraduate	Other prerequisites			
Conter		undergraduate				
		- modorn mathematical		computation (a. g. N	Nathomatica or Man	la) and nu
		o modern mathematical utation (e. g. Matlab) to				
		-G). Computer-based so				
		egral calculus; visualisa		0 0		
Intend	ed lear	ning outcomes				
		arns the use of advance		cal software package	es, and is able to as	sess their
fields of application to solve mathematical problems.						
Courses (type, number of weekly contact hours, language — if other than German)						
V (1) + \ddot{U} (2) Method of assessment (type, scope, language – if other than German, examination offered – if not every seme-						
		Sessment (type, scope, l on on whether module (0 0		tion offered — if not	every seme-
-	-	form of programming ex				
		ssessment: German and				
Assess	sment o	ffered: Once a year, win	ter semester			
Allocat	tion of _l	olaces				
Additio	onal inf	ormation				
Worklo	bad					
120 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination reg	ulations for teaching-	degree programmes)		
§ 22	Nr. 3 f)					
	e appea	urs in				
		gree (1 major) Mathema	tics (2015)			
Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015)						
Bachelor's degree (1 major) Kanostructure recimology (2015) Bachelor's degree (1 major) Economathematics (2015)						
Bachelor's degree (1 major) Athematical Physics (2015)						
Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Computational Mathematics (2015)						
Bachel	lor's de	gree (1 major) Functiona	ll Materials (2015)	-		
First st	ate exa	mination for the teachin	ng degree Gymnasium	Mathematics (2015)		
Bachel	lor's de	gree (1 major) Mathema	tical Physics (2016)			
Bachel	lor's de	gree (1 major) Economat	thematics (2017)			
First st	ate exa	mination for the teachir	ng degree Gymnasium	Mathematics (2019)		
Bachel	lor's de	gree (1 major) Physics (2	2020)			
Bachel	lor's de	gree (1 major) Nanostruo	cture Technology (202	o)		
Bachelor's (2015)	with 1 ma	jor Mathematical Physics	-	generated 18-Apr-2025 • exa r (180 ECTS) Mathematische	-	page 14 / 118

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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 (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) Mathematics (2023) Bachelor's degree (1 major) Economathematics (2023) Bachelor's degree (1 major) Economathematics (2024) Bachelor's degree (1 major) Functional Materials (2025) Bachelor's degree (1 major) Functional Materials (2025)

Module	e title				Abbreviation
Introdu	10-M-DGE-152-m01				
Module	e coord	inator		Module offered by	<u> </u>
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathem	natics
ECTS	1	od of grading	Only after succ. con	npl. of module(s)	
9	(not) s	successfully completed			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
particu	lar) in E		ure of hypersurfaces,		bmanifolds (hypersurfaces in es, main theorem on local sur-
Intend	ed lear	ning outcomes			
	ed with				ferential geometry. He/She is ac- ental proof methods indepen-
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	an)
V (4) +	Ü (2)				
ster, in	formati	Sessment (type, scope, la ion on whether module c mination (approx. 90 to a	an be chosen to earn	a bonus)	ntion offered — if not every seme
c) oral Langua	examin Ige of a ment o	nation of one candidate e ation in groups (groups of ssessment: German and ffered: In the semester in bonus	of 2, 10 to 15 minutes /or English	per candidate)	ubsequent semester
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
270 h					
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	llations for teaching-o	degree programmes)	
Module	e appea	ars in			
		gree (1 major) Mathemat	ics (2015)		
		gree (1 major) Mathemat	-		
		gree (1 major) Computati	,	015)	
D I I	or's de	gree (1 major) Mathemat			
		gree (1 major) Mathemat gree (1 major) Mathemat			

Module	e title				Abbreviation
Introdu	iction t	o Differential Geometry	for Mathematical Phy	sics	10-M-DGEP-152-m01
Module	o coord	inator		Module offered by	
		es Mathematik (Mathem	atice)	Institute of Mathem	natics
ECTS	ï	od of grading	Only after succ. com		latics
10	1	rical grade			
Duratio		Module level	Other prerequisites		
1 seme		undergraduate			
Conten	ts		,		
particu face th	lar) in I eory, sj	Euclidean spaces, curvat pecial classes of surface	ure of hypersurfaces,		bmanifolds (hypersurfaces in es, main theorem on local sur-
Intend	ed lear	ning outcomes			
	ed with				erential geometry. He/She is ac- ental proof methods indepen-
Course	s (type	, number of weekly conta	act hours, language —	if other than Germa	an)
V (4) +	Ü (2)				
ster, in a) oral b) oral Assess may on den (O' themat Langua Assess credita Allocat Additio	formati examir examir ment w ily be s verview ics). ige of a ment o ble for ion of p	ion on whether module c nation of one candidate e nation in groups of 2 can vill have reference to a to elected as the subject of Mathematical Methods ussessment: German and offered: In the semester in bonus	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in th) or in module group E /or English	a bonus) 5) or 1tes each) ics as agreed upon he sub-field Gesamt Frgänzung Mathema	ation offered — if not every seme- with the examiner. Each topic überblick Mathematische Metho tik (Supplementary Topics in Ma- ubsequent semester
Worklo	ad				
300 h	-				
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	lations for teaching-c	legree programmes)	
Module	e appea	ars in			
Bachel	or's de				
		gree (1 major) Mathemat	ical Physics (2015)		
		gree (1 major) Mathemat	ical Physics (2016)		
Bachel	or's de		ical Physics (2016) ical Physics (2020)		

	e title				Abbreviation
Overvi	ew Diffe	erential Geometry and O	rdinary Differential Eq	uations for Mathe-	10-M-DGGD-PÜ-152-m01
	l Physi				
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	1	od of grading	Only after succ. com	pl. of module(s)	
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	Its				
particu face th ons on	llar) in I eory, sj	Euclidean spaces, curvat pecial classes of surfaces values, systems of linear	ure of hypersurfaces, § s; existence and uniqu	geodesics, isometri eness theorem, cor	bmanifolds (hypersurfaces in es, main theorem on local sur- ntinuous dependence of soluti- l series, linear differential equati-
Intend	ed lear	ning outcomes			
dinary	differer		s able to relate these of	concepts with one a	al geometry and the theory of or- nother, and realises the advan-
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
V (4) +	Ü (2)				
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-
Assess may or den (O ^r themat	ment w nly be s verview tics).	elected as the subject of	topics in pure mathen one examination in th or in module group E	e sub-field Gesamt	on with the examiner. Each topic überblick Mathematische Metho- tik (Supplementary Topics in Ma-
Allocat	ion of j	olaces			
Additic	onal inf	ormation			
Worklo	ad				
390 h					
- •	ng cycl	P			
- cuciiii		~			
Doform	d to in	LPOI (examination regu	lations for tasching d	aroo programmaa)	
Referre	-u to in	LFUI (examination regu	iations for teaching-d	egree programmes)	
		· · · · • · ·			
	e appea				
Bachel	or's de	gree (1 major) Mathemati	• -		
Bachel Bachel	or's de or's de		cal Physics (2016)		

Modul	e title				Abbreviation
Ordina	ry Diffe	erential Equations			10-M-DGL-152-m01
Module	e coord	inator		Module offered by	<u> </u>
Dean o	of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Meth	od of grading	Only after succ. con	pl. of module(s)	
9	(not)	successfully completed			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	Its				
		uniqueness theorem; co tions; matrix exponentia			tial values; systems of linear dif- gher order.
Intend	ed lear	ning outcomes			
		acquainted with the fun /she is able to apply the			heory of ordinary differential
Course	s (type	, number of weekly conta	ct hours, language –	· if other than Germa	in)
V (4) +	Ü (2)				
b) oral c) oral Langua credita Allocat	examir examir age of a ble for tion of		ach (15 to 30 minutes of 2, 10 to 15 minutes	s) or	
Auunt		ormation			
Worklo	ad				
270 h	au				
	ng cycl	e			
	0 - 9 5				
Referre	ed to in	LPOI (examination regu	lations for teaching-o	legree programmes)	
Module	e appea	ars in			
Bachel Bachel Bachel	or's de or's de or's de	gree (1 major) Mathemati gree (1 major) Mathemati gree (1 major) Computatio gree (1 major) Mathemati gree (1 major) Mathemati	cal Physics (2015) onal Mathematics (20 cal Physics (2016)	015)	

	e title			<u>.</u>	Abbreviation
	-	rential Equations for Ma	thematical Physics		10-M-DGLP-152-m01
Module	e coord	inator		Module offered by	
Dean o	of Studie	es Mathematik (Mathema	atics)	Institute of Mather	natics
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
10	numei	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	Its				
ferentia	al equa	tions; matrix exponentia			itial values; systems of linear dif igher order.
Intend	ed learr	ning outcomes			
		acquainted with the fun /she is able to apply the			heory of ordinary differential
Course	s (type,	, number of weekly conta	act hours, language –	- if other than Germa	an)
V (4) +	Ü (2)				
		s essment (type, scope, la	anguage — if other tha	an German, examina	ation offered — if not every seme
a) oral b) oral Assess may or	examin examin ment w nly be se	elected as the subject of	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Metho
a) oral b) oral Assess may or den (O themat Langua credita	examin examin ment w nly be se verview tics). age of a ble for	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam	
a) oral b) oral Assess may or den (O themat Langua credita	examin examin ment w nly be se verview tics). age of a	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Metho
a) oral b) oral Assess may or den (O themat Langua credita Allocat	examin examin ment w ly be so verview tics). age of a ble for ion of p	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Metho
a) oral b) oral Assess may or den (O themat Langua credita Allocat	examin examin ment w ly be so verview tics). age of a ble for ion of p	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Metho
a) oral b) oral Assess may or den (O themat Langua credita Allocat	examin examin ment w ly be so verview tics). age of a ble for ion of p	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Metho
a) oral b) oral Assess may or den (O themat Langua credita Allocat	examin examin ment w ly be so verview tics). age of a ble for tion of p	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Metho
a) oral b) oral Assess may or den (O themat Langua credita Allocat	examin examin ment w ly be so verview tics). age of a ble for tion of p	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Meth
a) oral b) oral Assess may or den (O themat Langua credita Allocat Additic Worklo 300 h	examin examin ment w ly be so verview tics). age of a ble for tion of p	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus blaces	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Metho
a) oral b) oral Assess may or den (O themat Langua credita Allocat Additic Worklo 300 h	examin examin ment w ily be so verview tics). age of a ble for tion of p onal info	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus blaces	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Metho
a) oral b) oral Assess may or den (O themat Langua credita Allocat Morklo 300 h Teachin	examin examin ment w nly be so verview tics). age of a ble for tion of p onal info pad	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus blaces	an be chosen to earn ach (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f /or English	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	with the examiner. Each topic tüberblick Mathematische Methe atik (Supplementary Topics in Ma
a) oral b) oral Assess may or den (O themat Langua credita Allocat Morklo 300 h Teachin Referre	examin examin ment w nly be so verview tics). age of a ble for tion of p onal info pad	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus blaces	an be chosen to earn ach (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f /or English	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	with the examiner. Each topic tüberblick Mathematische Methe atik (Supplementary Topics in Ma
a) oral b) oral Assess may or den (O themat Langua credita Allocat Worklo 300 h Teachi Referre	examin examin ment w oly be so verview tics). age of a ble for tics of p onal info onal info onal info onal info	ation of one candidate e ation in groups of 2 cand ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus blaces ormation	an be chosen to earn ach (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f /or English	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	with the examiner. Each topic tüberblick Mathematische Meth atik (Supplementary Topics in Ma
a) oral b) oral Assess may or den (O themat Langua credita Allocat Additic 300 h Teachin Referre	examin examin ment w hly be so verview tics). age of a ble for tion of p onal info pad	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus blaces ormation e LPO I (examination regu	an be chosen to earn ach (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group B /or English	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	with the examiner. Each topic tüberblick Mathematische Meth atik (Supplementary Topics in Ma
a) oral b) oral Assess may or den (O themat Langua credita Allocat Worklo 300 h Teachin Referre Bachel	examin examin ment w ily be so verview tics). age of a ble for ion of p onal info onal info oad ed to in e appea or's deg	ation of one candidate e ation in groups of 2 cano- ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus places prmation e LPO I (examination regu ars in gree (1 major) Mathemati	an be chosen to earn ach (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f /or English /or English ulations for teaching-o	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	with the examiner. Each topic tüberblick Mathematische Meth atik (Supplementary Topics in Ma
a) oral b) oral Assess may or den (O themat Langua credita Allocat Morklo 300 h Teachi Referre Bachel Bachel	examin examin ment w oly be so verview tics). age of a ble for ion of p onal info pad ad ad ad ad ad ad ad ad ad ad ad ad a	ation of one candidate e ation in groups of 2 cano ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus blaces ormation e LPO I (examination regu	an be chosen to earn each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f /or English /or English ulations for teaching-o	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	with the examiner. Each topic tüberblick Mathematische Meth atik (Supplementary Topics in Ma

Module	e title				Abbreviation
Overvie	ew Diffe	erential Geometry and Pa	rtial Differential Equ	ations for Mathe-	10-M-DGPA-PÜ-152-m01
matica					_
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathen	natics
ECTS		od of grading	Only after succ. com	pl. of module(s)	
13	nume	rical grade			
Duratio		Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
particu face th ons of t	lar) in E eory, sj first ord	Euclidean spaces, curvati pecial classes of surfaces	ure of hypersurfaces, ; examples of partial eness theorems, basi	geodesics, isometri differential equatio	bmanifolds (hypersurfaces in ies, main theorem on local sur- ns and partial differential equati- iematical physics, boundary value
Intende	ed lear	ning outcomes			
partial	differe		s able to relate these	concepts with one	ial geometry and the theory of another, and realises the advan-
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	an)
V (4) +	Ü (2)				
		sessment (type, scope, la on on whether module ca			ation offered — if not every seme-
Assess may on den (Ov themat	ment w Ily be s verview ics).	elected as the subject of	topics in pure mathe one examination in t or in module group E	he sub-field Gesamt	oon with the examiner. Each topic tüberblick Mathematische Metho- tik (Supplementary Topics in Ma-
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
Worklo	ad				
390 h					
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	lations for teaching-c	legree programmes)	
Module	e appea	ars in			
		gree (1 major) Mathemati	cal Physics (2015)		
		gree (1 major) Mathemati	• -		
		gree (1 major) Mathemati	•		
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2024)		

Module					Abbreviation
Introdu	iction t	to Discrete Mathemat	ics for Mathematical Phy	ysics	10-M-DIMP-152-m01
Module	e coord	linator		Module offered by	·
Dean o	f Studi	es Mathematik (Math	ematics)	Institute of Mather	natics
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites	;	
1 seme	ster	undergraduate			
Conten	ts				
		om combinatorics, int 1g codes.	roduction to graph theo	ry (including applica	tions), cryptographic methods,
Intend	ed lear	ning outcomes			
levant realise	proof t s the s	echniques, is able to a cope of applications o	apply methods from nun f discrete structures.	nber theory and alge	e mathematics, masters the re- bra to discrete mathematics and
		, number of weekly co	ontact hours, language –	 if other than Germa 	an)
V (4) +	Ü (2)				
			e, language — if other th le can be chosen to earn		ation offered — if not every seme
b) oral c) oral	examiı examir ıge of a	nation of one candida nation in groups (grou assessment: German a	to 180 minutes, usually te each (15 to 30 minute ps of 2, 10 to 15 minutes and/or English	s) or	
Allocat	ion of				
		places			
		places			
 Additio		places			
 Additio					
 Additic Worklo	onal inf				
	onal inf				
 Workla	onal inf oad	formation			
 Worklo 300 h	onal inf oad	formation			
 Worklo 300 h Teachi	nal inf ad ng cycl	formation le	egulations for teaching-	degree programmes)
 Worklo 300 h Teachi	nal inf ad ng cycl	formation le	egulations for teaching-	degree programmes)
 Worklo 300 h Teachin Referre	nal inf ad ng cycl ed to in	Formation	egulations for teaching-	degree programmes	
 Worklo 300 h Teachin Referre Modulo	ad ng cycl ed to in	Formation Le LPO I (examination r		degree programmes)
 Worklo 300 h Teachin Referre Bachel	enal inf ad ng cycl ed to in e appea or's de	Termation LPO I (examination r ars in gree (1 major) Mather	egulations for teaching- natical Physics (2015) natical Physics (2016)	degree programmes)
 Worklo 300 h Teachii Referre Module Bachel Bachel	ad ng cycl ed to in e appea or's de or's de	Termation Ie LPO I (examination r ars in gree (1 major) Mather gree (1 major) Mather	natical Physics (2015)	degree programmes)

Module					Abbreviation
Overvie	ew Fund	tional Analysis and Diffe	erential Geometry for	Mathematical Phy-	10-M-FADG-PÜ-152-m01
sics					5
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)	
13	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
spaces	, curva , curva	ture, Frenet equations, lo	cal classification, sul	bmanifolds (hypersu	analysis; curves in Euclidean ırfaces in particular) in Euclidean al surface theory, special classe
Intende	ed lear	ning outcomes			
lysis. H the bor	e/She ders of	is able to relate these co different branches in ma	ncepts with one anot athematics.	her, and realises the	al geometry and functional ana- advantages of thinking across
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
V (4) +	Ü (2)				
ster, in oral exa Assess may on den (Ov themat	formati aminat ment w ly be s verview ics).	on on whether module ca ion of one candidate each ill have reference to two elected as the subject of	an be chosen to earn h (20 to 40 minutes) topics in pure mathe one examination in th or in module group E	a bonus) matics as agreed up he sub-field Gesamt	tion offered — if not every seme- on with the examiner. Each topic überblick Mathematische Metho tik (Supplementary Topics in Ma-
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
390 h					
Teachi	ng cvcl	6			
	<u> </u>	-			
Poforro	d to in	LPOI (examination regu	lations for toaching a	lagree programmac)	
Referre			tations for teaching-t		
Module					
		gree (1 major) Mathemati			
		gree (1 major) Mathemati gree (1 major) Mathemati			
		gree (1 major) Mathemati gree (1 major) Mathemati	•		
Duchel	or 5 ue	Siec (I major) mathemati	cuti fiysics (2024)		

Module	e title				Abbreviation
		tional Analysis and Com	plex Analysis for Ma	•	10-M-FAFT-PÜ-152-m01
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
lity and ties, m	l Cauch eromor	y-Riemann differential ec	quations, path integra nt series, residue the	als and Cauchy integ	analysis; complex differentiabi- gral theorems, isolated singulari- ons, Weierstraß product theorem
Intend	ed lear	ning outcomes			
sis. He border	/She is s of diff	able to relate these conc erent branches in mathe	cepts with one anothe matics.	er, and realises the a	al analysis and complex analy- advantages of thinking across the
		, number of weekly conta	ct nours, language –	- if other than Germa	in)
V (4) +					
		s essment (type, scope, la on on whether module ca			tion offered — if not every seme
Assess may or den (O ^r themat	ment w Ily be s verview ics).	elected as the subject of	topics in pure mathe one examination in t or in module group E	he sub-field Gesamt	on with the examiner. Each topic überblick Mathematische Metho tik (Supplementary Topics in Ma
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
 Workla	ad				
390 h					
Teachi		8			
	is cycl				
	d to in	IDOL (overside the second	lations for taashing	logroo programme>	
Relefte		LPOI (examination regu	tations for teaching-0	regree programmes)	
		•			
Module					
		gree (1 major) Mathemati	• -		
		gree (1 major) Mathemati			
		gree (1 major) Mathemati gree (1 major) Mathemati			
	บเวนย	siee (I majui) Malifellidli	Lai FIIVSILS (2024)		

_	e title				Abbreviation
Overvi	ew Fun	ctional Analysis and Geo	ometric Analysis for N	Aathematical Phy-	10-M-FAGA-PÜ-152-m01
sics					_
Module	e coord	linator		Module offered by	
Dean o	of Studi	es Mathematik (Mathem	atics)	Institute of Mather	natics
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites	i	
1 seme	ester	undergraduate			
Conten	nts				
sis on i sis and	manifo d topolo	lds, submanifolds, calcu ogy.			l analysis; fundamentals in analy and applications in vector analy-
Intend	ed lear	ning outcomes			
sis. He	/She is		cepts with one anoth		al analysis and geometric analy- advantages of thinking across the
Course	es (type	, number of weekly conta	act hours, language –	 if other than Germa 	an)
V (4) +	Ü (2)				
		sessment (type, scope, la ion on whether module c			ation offered — if not every seme-
oral ex	-			a bonus)	
Assess may or den (O ^r themat	aminat sment v nly be s verviev tics).	ion of one candidate eac vill have reference to two elected as the subject of	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group	ematics as agreed up the sub-field Gesam	oon with the examiner. Each topic tüberblick Mathematische Metho atik (Supplementary Topics in Ma-
Assess may or den (O ^r themat	aminat sment v nly be s verviev tics). age of a	ion of one candidate eac vill have reference to two elected as the subject of v Mathematical Methods assessment: German and	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group	ematics as agreed up the sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O themat Langua	aminat sment v nly be s verviev tics). age of a	ion of one candidate eac vill have reference to two elected as the subject of v Mathematical Methods assessment: German and	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group	ematics as agreed up the sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O themat Langua Allocat	aminat sment v nly be s verviev tics). age of a tion of	ion of one candidate eac vill have reference to two elected as the subject of v Mathematical Methods assessment: German and	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group	ematics as agreed up the sub-field Gesam	tüberblick Mathematische Metho
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Assess may or den (O themat Langua Allocat	aminat sment v nly be s verviev tics). age of a tion of pnal inf	ion of one candidate eac vill have reference to two elected as the subject of v Mathematical Methods assessment: German and places	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group	ematics as agreed up the sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O' themat Langua Allocat Additic Worklo	aminat sment v nly be s verviev tics). age of a tion of pnal inf	ion of one candidate eac vill have reference to two elected as the subject of v Mathematical Methods assessment: German and places	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group	ematics as agreed up the sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O themat Langua Allocat Additio Worklo 390 h	aminat sment v nly be s verviev tics). age of a tion of pnal inf	ion of one candidate eac vill have reference to two selected as the subject of v Mathematical Methods assessment: German and places	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group	ematics as agreed up the sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O' themat Langua Allocat Additic Worklo	aminat sment v nly be s verviev tics). age of a tion of pnal inf	ion of one candidate eac vill have reference to two selected as the subject of v Mathematical Methods assessment: German and places	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group	ematics as agreed up the sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O themat Langua Allocat Worklo 390 h Teachin 	aminat sment v nly be s verviev tics). age of a tion of onal inf	ion of one candidate eac vill have reference to two selected as the subject of v Mathematical Methods assessment: German and places formation	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group /or English	ematics as agreed up the sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho atik (Supplementary Topics in Ma
Assess may or den (O themat Langua Allocat Worklo 390 h Teachin 	aminat sment v nly be s verviev tics). age of a tion of onal inf	ion of one candidate eac vill have reference to two selected as the subject of v Mathematical Methods assessment: German and places	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group /or English	ematics as agreed up the sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho atik (Supplementary Topics in Ma
Assess may or den (O' themat Langua Allocat Worklo 390 h Teachin Referre	aminat sment v nly be s verviev tics). age of a tion of onal inf oad	ion of one candidate eac vill have reference to two elected as the subject of v Mathematical Methods assessment: German and places formation	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group /or English	ematics as agreed up the sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho atik (Supplementary Topics in Ma
Assess may or den (O' themat Langua Allocat Additic 390 h Teachin Referre Modulo	aminat sment v nly be s verviev tics). age of a tion of onal inf oad ng cycl ed to in	ion of one candidate eac vill have reference to two selected as the subject of v Mathematical Methods assessment: German and places formation	h (20 to 40 minutes) topics in pure mathe one examination in t) or in module group /or English	ematics as agreed up the sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho atik (Supplementary Topics in Ma
Assess may or den (O themat Langua Allocat Worklo 390 h Teachin Referre Bachel	aminat sment v nly be s verviev tics). age of a tion of onal inf onal inf oad age cycl ed to in e appea lor's de	ion of one candidate eac vill have reference to two selected as the subject of v Mathematical Methods assessment: German and places formation	ch (20 to 40 minutes) topics in pure mathe one examination in t) or in module group /or English /or English ulations for teaching-o	ematics as agreed up the sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho atik (Supplementary Topics in Ma
Assess may or den (O' themat Langua Allocat Worklo 390 h Teachin Referre Bachel Bachel	aminat sment v nly be s verviev tics). age of a tion of onal inf onal inf oad ng cycl ed to in e appea lor's de lor's de	ion of one candidate eac vill have reference to two selected as the subject of v Mathematical Methods assessment: German and places formation	ical Physics (2015) ical Physics (2015)	ematics as agreed up the sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho atik (Supplementary Topics in Ma

Module	e title				Abbreviation
Overvi	ew Fun	ctional Analysis and Ordi	nary Differential Equ	ations for Mathe-	10-M-FAGD-PÜ-152-m01
matica	l Physi	cs			
Module	e coord	inator		Module offered by	-
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	Its				
ess the	eorem,		of solutions on initial	values, systems of	analysis; existence and uniquen linear differential equations, ma-
Intend	ed lear	ning outcomes			
nary di	fferent	•	able to relate these co	oncepts with one an	al analysis and the theory of ordiother, and realises the advanta-
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	an)
V (4) +	Ü (2)				
oral ex Assess may or den (O themat	aminat ment v nly be s verviev tics).	elected as the subject of	h (20 to 40 minutes) topics in pure mathe one examination in t or in module group B	matics as agreed up he sub-field Gesamt	oon with the examiner. Each topic überblick Mathematische Metho tik (Supplementary Topics in Ma
Allocat	ion of	places			
Additio	onal inf	ormation			
Worklo	ad				
390 h					
Teachi		۵			
	5 cycl	~			
		IDOI (overningtion rest	lations for togetime	dograa nyagyang	
Reieffe		LPOI (examination regu	iations for teaching-0	legree programmes)	
		•			
Module					
		gree (1 major) Mathemati	• •		
		gree (1 major) Mathemati	•		
		gree (1 major) Mathemati gree (1 major) Mathemati	•		
Dachel	or s ue	gree (1 major) mathemati	cai Filysics (2024)		

Module	e title				Abbreviation
Introdu	uction t	o Functional Analysis			10-M-FAN-152-m01
Module	e coord	inator	Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
9	(not) s	successfully completed		•	
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	its				
Banach	n space	s and Hilbert spaces, bo	unded operators, prir	ciples of functional	analysis.
Intende	ed lear	ning outcomes			
method	ds, is al		n linear algebra and a	analysis to functiona	is as well as the pertinent proof al analysis, and realises the
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
V (4) +	Ü (2)				
		essment (type, scope, la on on whether module ca			tion offered — if not every seme-
b) oral c) oral	examir examin age of a	mination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ssessment: German and, bonus	ach (15 to 30 minutes of 2, 10 to 15 minutes	s) or	
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
Worklo	ad				
270 h					
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	lations for teaching-c	legree programmes)	
§ 22	Nr. 3 f)				
Module	e appea	ars in			
Bachel Bachel First sta Bachel First sta First sta	or's de or's de ate exa or's de ate exa ate exa	gree (1 major) Mathemati gree (1 major) Mathemati gree (1 major) Computation mination for the teaching gree (1 major) Mathemati mination for the teaching mination for the teaching gree (1 major) Mathemati	cal Physics (2015) onal Mathematics (20 g degree Gymnasium cal Physics (2016) g degree Gymnasium g degree Gymnasium	Mathematics (2015) Mathematics (2019)	

	e title				Abbreviation
Introdu	uction t	o Functional Analysis for	Mathematical Physi	cs	10-M-FANP-152-m01
Modul	e coord	inator		Module offered by	
Dean o	of Studi	es Mathematik (Mathema	atics)	Institute of Mather	natics
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ester	undergraduate			
Conter	nts		·		
Banacl	n space	s and Hilbert spaces, bo	unded operators, prir	nciples of functional	l analysis.
Intend	ed lear	ning outcomes			
metho	ds, is a		m linear algebra and	analysis to function	sis as well as the pertinent proof al analysis, and realises the
Course	s (type	, number of weekly conta	act hours, language —	- if other than Germa	an)
V (4) +	Ü (2)				
					ation offered — if not every seme
b) oral Assess may or	examir sment w nly be s	nation of one candidate e nation in groups of 2 cand vill have reference to a to elected as the subject of	didates (10 to 15 minu pic in pure mathemat one examination in t	s) or utes each) tics as agreed upon he sub-field Gesam	
b) oral Assess may or den (O themat Langua	examir sment w nly be s verview tics).	nation of one candidate e nation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	s) or utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
b) oral Assess may or den (O themat Langua credita	examir sment w nly be s verview tics). age of a	nation of one candidate en nation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	s) or utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
b) oral Assess may or den (O themat Langua credita	examir ment w nly be s verview tics). age of a ble for	nation of one candidate en nation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	s) or utes each) tics as agreed upon he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Metho atik (Supplementary Topics in Ma
b) oral Assess may or den (O themat Langua credita Allocat	examir ment w nly be s verview tics). age of a ble for tion of p	nation of one candidate en nation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	s) or utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
b) oral Assess may or den (O themat Langua credita Allocat	examir ment w nly be s verview tics). age of a ble for tion of p	nation of one candidate en nation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus blaces	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	s) or utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
b) oral Assess may or den (O themat Langua credita Allocat	examir sment w nly be s verview tics). age of a ble for tion of p	nation of one candidate en nation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus blaces	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	s) or utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
b) oral Assess may or den (O themat Langua credita Allocat Additic	examir sment w nly be s verview tics). age of a ble for tion of p	nation of one candidate en nation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus blaces	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	s) or utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
b) oral Assess may or den (O themat Langua credita Allocat Additio Worklo 300 h	examir sment w nly be s verview tics). age of a ble for tion of p	nation of one candidate enation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus blaces	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	s) or utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
b) oral Assess may or den (O themat Langua credita Allocat Additio Worklo 300 h	examir sment w aly be s verview tics). age of a ble for tion of p onal inf	nation of one candidate enation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus blaces	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group f	s) or utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Meth
b) oral Assess may or den (O themat Langua credita Allocat Additio 300 h Teachi 	examir ment w nly be s verview tics). age of a ble for tion of j onal inf pad	nation of one candidate enation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus blaces	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group B /or English	s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Methe atik (Supplementary Topics in Ma
b) oral Assess may or den (O themat Langua credita Allocat Additio 300 h Teachi 	examir ment w nly be s verview tics). age of a ble for tion of j onal inf pad	eation of one candidate enation in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus blaces ormation	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group B /or English	s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Meth atik (Supplementary Topics in Ma
b) oral Assess may or den (O themat Langua credita Allocat Additio 300 h Teachi Referro	examir ment w nly be s verview tics). age of a ble for tion of j onal inf pad	e LPOI (examination regu	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group B /or English	s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Meth htik (Supplementary Topics in Ma
b) oral Assess may or den (O themat Langua credita Allocat Additic Worklc 300 h Teachi Referre	examir sment w nly be s verview tics). age of a ble for tion of p onal inf onal inf oad ng cycl	e LPOI (examination regu	each (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group B /or English	s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Meth atik (Supplementary Topics in M
b) oral Assess may or den (O themat Langua credita Allocat Additio Bachel Bachel	examir ment w aly be s verview tics). age of a ble for tion of p onal inf onal inf oad ad ed to in e appea or's de	e LPOI (examination regu	ach (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group B /or English ulations for teaching-o	s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Meth htik (Supplementary Topics in Ma
b) oral Assess may or den (O themat Langua credita Allocat Worklo 300 h Teachi Referro Bachel Bachel Bachel Bachel	examir ment w aly be s verview tics). age of a ble for tion of p onal inf pad ad ad ad ad ad ad ad ad ad ad ad ad a	aation of one candidate e nation in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus blaces ormation e LPO I (examination regu ars in gree (1 major) Mathemati	ach (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group B /or English 	s) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Meth htik (Supplementary Topics in Ma

Module	e title				Abbreviation
Overvi	ew Fun	ctional Analysis and Part	ial Differential Equat	ions for Mathemati-	10-M-FAPA-PÜ-152-m01
cal Phy	ysics				
Modul	e coord	inator		Module offered by	
Dean o	of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	CTS Method of grading Only after succ. compl. of module(s)				
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ester	undergraduate			
Conten	nts				
ferentia	al equa	tions and partial differen	tial equations of first	order, existence and	analysis; examples of partial dif d uniqueness theorems, basic ple and Dirichlet problem.
Intend	ed lear	ning outcomes			
tial diff	ferentia		ble to relate these co	ncepts with one ano	al analysis and the theory of par- ther, and realises the advantage
Course	es (type	, number of weekly conta	ict hours, language —	- if other than Germa	n)
V (4) +	Ü (2)				
		sessment (type, scope, la ion on whether module c			tion offered — if not every seme-
may or den (O themat	nly be s verviev tics). age of a	elected as the subject of Mathematical Methods)	one examination in t or in module group E	he sub-field Gesamt	on with the examiner. Each topic überblick Mathematische Metho tik (Supplementary Topics in Ma
Additic	nal inf	ormation	·		
W					
Worklo	bad				
worкid 390 h	oad				
		e			
390 h		e			
390 h Teachi 	ng cycl	e LPOI (examination regu	lations for teaching-o	legree programmes)	
390 h Teachi 	ng cycl		lations for teaching-c	legree programmes)	
390 h Teachi Referre	ng cycl ed to in	LPOI (examination regu	lations for teaching-o	degree programmes)	
390 h Teachi Referre Module	ng cycl ed to in e appea	LPOI (examination regu		degree programmes)	
390 h Teachi Referre Module Bachel	ng cycl ed to in e appea lor's de	LPOI (examination regu	ical Physics (2015)	degree programmes)	
390 h Teachi Referre Module Bachel Bachel	ng cycl ed to in e appea lor's de lor's de	LPO I (examination regu ars in gree (1 major) Mathemati	ical Physics (2015) ical Physics (2016)	degree programmes)	

Module	e title				Abbreviation						
Overvie	ew Com	plex Analysis and Differ	ential Geometry for N	Nathematical Phy-	10-M-FTDG-PÜ-152-m01						
sics											
Module	e coord	inator		Module offered by							
Dean of Studies Mathematik (Mathematics) Institute of Mathematic				natics							
ECTS	CTS Method of grading Only after succ. compl. of module(s)										
13	nume	rical grade									
Duratio	on	Module level	Other prerequisites								
1 seme	ster	undergraduate									
Conten	ts										
rems, is erstraß Frenet o of hype	solated produce equation ersurface	l singularities, meromorp ct theorem and theorem ons, local classification, s ces, geodesics, isometrie	hic functions and Lau of Mittag-Leffler, conf submanifolds (hypers	urent series, residue ormal maps; curves urfaces in particular	grals and Cauchy integral theo- theorem and applications, Wei- in Euclidean spaces, curvature, in Euclidean spaces, curvature special classes of surfaces.						
Intende	ed lear	ning outcomes									
try. He/	She is	•	epts with one anothe	•	analysis and differential geome- dvantages of thinking across the						
Course	s (type	, number of weekly conta	ict hours, language —	if other than Germa	ın)						
V (4) +	Ü (2)										
		essment (type, scope, la on on whether module ca			tion offered — if not every seme-						
Assess may on den (Ov themat	ment w Ily be s verview ics).	elected as the subject of	topics in pure mather one examination in the or in module group E	he sub-field Gesamt	on with the examiner. Each topic überblick Mathematische Metho- tik (Supplementary Topics in Ma-						
Allocat											
Additio	nal inf	ormation									
Worklo	ad										
390 h											
Teachi	ng cycl	e									
Referre	d to in	LPOI (examination regu	lations for teaching-c	legree programmes)							
Module	e appea	urs in									
		gree (1 major) Mathemati	cal Physics (2015)								
					Bachelor's degree (1 major) Mathematical Physics (2016)						
Bachel	or 5 uc	giee (I majoi) mameman	cal Physics (2020)								

Module	e title				Abbreviation
Overvie	ew Com	plex Analysis and Ordina	ary Differential Equat	ions for Mathema-	10-M-FTGD-PÜ-152-m01
tical Ph					-
Module	e coord	inator		Module offered by	
Dean o	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS					
13	nume	rical grade			
Duratio		Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
rems, is erstraß continu	solated produc ious de	singularities, meromorp tt theorem and theorem o	hic functions and Lau of Mittag-Leffler, conf n initial values, syste	urent series, residue ormal maps; exister	grals and Cauchy integral theo- theorem and applications, Wei- nce and uniqueness theorem, itial equations, matrix exponenti-
Intende	ed learı	ning outcomes			
nary di	fferenti		able to relate these co	oncepts with one an	analysis and the theory of ordi- other, and realises the advanta-
Course	s (type	, number of weekly conta	ct hours, language —	· if other than Germa	ın)
V (4) +	Ü (2)				
		s essment (type, scope, la on on whether module ca			tion offered — if not every seme-
Assess may on den (Ov themat	ment w Ily be so verview ics).	elected as the subject of	topics in pure mathe one examination in tl or in module group E	he sub-field Gesamt	on with the examiner. Each topic überblick Mathematische Metho- tik (Supplementary Topics in Ma-
Allocat					
Additio	nal inf	ormation			
Worklo	ad				
390 h					
Teachi	ng cvcl	e			
	<u> </u>				
Referre	d to in	LPOI (examination regu	lations for teaching-c	legree programmes)	
Module	e appea	ars in			
		gree (1 major) Mathemati	cal Physics (2015)		
		gree (1 major) Mathemati	• -		
		gree (1 major) Mathemati			
Bachel	or's deg	gree (1 major) Mathemati	cal Physics (2024)		

Module	e title				Abbreviation
Introdu	iction t	o Complex Analysis			10-M-FTH-152-m01
Module	e coord	inator		Module offered by	<u> </u>
Dean o	fStudi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	CTS Method of grading Only after succ			npl. of module(s)	
9	(not) s	successfully completed			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
rems, i	solated		hic functions and Lau	urent series, residue	grals and Cauchy integral theo- theorem and applications, Wei-
Intende	ed lear	ning outcomes			
		acquainted with the fun ethods to practical probl		nd methods in comp	plex analysis. He/she is able to
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	an)
V (4) +					
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-
c) oral	examin Ige of a	nation of one candidate e ation in groups (groups o ssessment: German and, bonus	of 2, 10 to 15 minutes	-	
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
Worklo	ad				
270 h					
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	lations for teaching-o	degree programmes)	
Module	e appea	ars in			
		gree (1 major) Mathemati	cs (2015)		
		gree (1 major) Mathemati			
		gree (1 major) Computati	• -	015)	
		gree (1 major) Mathemati	•		
Dechal	or's da	gree (1 major) Mathemati	cc(aaaa)		

Modul					Abbreviation
Introdu	uction t	o Complex Analysis for N	Nathematical Physics	5	10-M-FTHP-152-m01
Modul	e coord	inator		Module offered by	<u> </u>
Dean o	of Studi	es Mathematik (Mathema	atics)	Institute of Mathen	natics
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	ester	undergraduate			
Conter	nts				
rems, i	solated		hic functions and La	urent series, residue	grals and Cauchy integral theo- theorem and applications, Wei-
Intend	ed lear	ning outcomes			
		acquainted with the fun ethods to practical probl		nd methods in com	plex analysis. He/she is able to
Course	s (type	, number of weekly conta	ict hours, language —	- if other than Germa	an)
V (4) +	Ü (2)				
a) oral b) oral Assess may or den (O themat Langua credita Allocat	examir examir sment w nly be s verview tics).	elected as the subject of / Mathematical Methods) ssessment: German and bonus	ach (15 to 30 minutes didates (10 to 15 minu pic in pure mathemat one examination in t or in module group F	5) or utes each) tics as agreed upon he sub-field Gesamt	with the examiner. Each topic überblick Mathematische Metho tik (Supplementary Topics in Ma
Auditio	onal inf	ormation			
		ormation			
 Worklo		ormation			
 Worklo 300 h	oad				
 Worklo 300 h					
 Worklo 300 h Teachi 	oad ng cycl	e	lations for teaching.c	legree programmes	
 Worklo 300 h Teachi 	oad ng cycl		lations for teaching-o	degree programmes)	
 Worklo 300 h Teachi Referro	ng cycl ed to in	e LPOI (examination regu	lations for teaching-o	degree programmes)	
 Worklo 300 h Teachi Referre Module	oad ng cycl ed to in e appea	e LPOI (examination regu		degree programmes)	
 Worklo 300 h Teachi Referre Module Bachel	ng cycl ed to in e appea or's de	e LPOI (examination regu ars in gree (1 major) Mathemat	cal Physics (2015)	degree programmes)	
 Worklo 300 h Teachi Referre Module Bachel Bachel	ng cycl ed to in e appea or's de or's de	e LPOI (examination regu	cal Physics (2015) cal Physics (2016)	degree programmes)	

Module	e title				Abbreviation
Overvi	ew Con	plex Analysis and Partia	l Differential Equatio	ns for Mathemati-	10-M-FTPA-PÜ-152-m01
cal Phy	/sics				
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Methe	od of grading	Only after succ. com	pl. of module(s)	
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	Its				
rems, i	solated		hic functions and Lau	urent series, residue	grals and Cauchy integral theo- theorem and applications, Wei-
Intend	ed lear	ning outcomes			
differe	ntial eq		to relate these concep	ots with one another	analysis and the theory of partia r, and realises the advantages of
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	in)
V (4) +	Ü (2)				
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-
may or den (O ^r themat	nly be s verview tics). age of a	elected as the subject of Mathematical Methods)	one examination in t or in module group E	he sub-field Gesamt	on with the examiner. Each topic überblick Mathematische Metho tik (Supplementary Topics in Ma
/illocul					
Additio	nalinf	ormation			
Auditio					
 Worklo	ad				
390 h	uu				
Teachi	ng cvcl	e			
	0 .,				
_	ed to in	IPOI (examination regu			
Referre		LIVI (Crannation regu	lations for teaching-c	legree programmes)	
Referre	<u>u to in</u>		lations for teaching-c	legree programmes)	
			lations for teaching-c	legree programmes)	
 Module	e appea	ars in		legree programmes)	
 Module Bachel	e appea or's de		cal Physics (2015)	legree programmes)	
 Module Bachel Bachel	e appea or's de or's de	ars in gree (1 major) Mathemati	cal Physics (2015) cal Physics (2016)	legree programmes)	

Modul					Abbreviation
Overvi	ew Geo	metric Analysis and D	ifferential Geometry for	Mathematical Phy-	10-M-GADG-PÜ-152-m01
sics					2
Modul	e coord	linator		Module offered by	
Dean o	of Studi	es Mathematik (Mathe	ematics)	Institute of Mathem	natics
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conter	nts	•			
cations tion, su	s in veo ubman	tor analysis and topole ifolds (hypersurfaces i	ogy; curves in Euclidean	n spaces, curvature, l n spaces, curvature	orms, Stoke's theorem and appli Frenet equations, local classifica of hypersurfaces, geodesics, iso
Intend	ed lear	ning outcomes			
metry.	He/Sh		e concepts with one and		c analysis and differential geo- e advantages of thinking across
Course	s (type	, number of weekly co	ntact hours, language –	- if other than Germa	n)
V (4) +	Ü (2)				
oral ex Assess may or den (O themat	aminat sment v nly be s verviev tics).	ion of one candidate e vill have reference to ty elected as the subject	of one examination in t ds) or in module group f	matics as agreed up he sub-field Gesamt	on with the examiner. Each topi überblick Mathematische Metho tik (Supplementary Topics in Ma
Allocat	tion of	places			
Additio	onal inf	ormation			
Worklo	ad				
390 h					
Teachi	ng cycl	٥			
reacili	ing cycl	G			
 D-(1	
Referre	ed to in	LPUI (examination re	egulations for teaching-o	legree programmes)	
Modul					
		gree (1 major) Mathem	• -		
		gree (1 major) Mathem	-		
Bachel	or's de	gree (1 major) Mathem	atical Physics (2020)		
Declard	ا مار م	gree (1 major) Mathem	-		

	e title				Abbreviation
		metric Analysis and Com	plex Analysis for Ma	-	10-M-GAFT-PÜ-152-m01
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	CTS Method of grading Only after succ.			pl. of module(s)	
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	Its				
licatior path in	ns in ve Itegrals	ctor analysis and topolog and Cauchy integral the	gy; complex differenti prems, isolated singu	ability and Cauchy-F Ilarities, meromorph	orms, Stoke's theorem and app- Riemann differential equations, ic functions and Laurent series, Mittag-Leffler, conformal maps.
Intend	ed lear	ning outcomes			
sis. He border	/She is s of diff	able to relate these con- erent branches in mathe	cepts with one anothe matics.	er, and realises the a	c analysis and complex analy- advantages of thinking across th
		, number of weekly conta	ict hours, language –	- if other than Germa	in)
V (4) +	Ü (2)				
ster, in oral ex Assess may or	formati aminat ment w nly be s verview	on on whether module c ion of one candidate eac vill have reference to two elected as the subject of	an be chosen to earn h (20 to 40 minutes) topics in pure mathe one examination in t	a bonus) matics as agreed up he sub-field Gesamt	tion offered — if not every seme on with the examiner. Each topi überblick Mathematische Metho
	,	ssessment: German and		Ergänzung Mathema	tik (Supplementary Topics in Ma
Langua	age of a	ssessment: German and places		Ergänzung Mathema	tik (Supplementary Topics in Ma
Langua	,	-		Ergänzung Mathema	tik (Supplementary Topics in Ma
Langua Allocat	age of a	-		Ergänzung Mathema	tik (Supplementary Topics in Ma
Langua Allocat	age of a	olaces		Ergänzung Mathema	tik (Supplementary Topics in Ma
Langua Allocat	age of a tion of p	olaces		Ergänzung Mathema	tik (Supplementary Topics in Ma
Langua Allocat Additic	age of a tion of p	olaces		Ergänzung Mathema	tik (Supplementary Topics in Ma
Langua Allocat Additio Worklo 390 h	age of a tion of p	olaces ormation		Ergänzung Mathema	tik (Supplementary Topics in Ma
Langua Allocat Additio Worklo 390 h	age of a ion of p onal info	olaces ormation		Ergänzung Mathema	tik (Supplementary Topics in Ma
Langua Allocat Additic Worklo 390 h Teachin 	age of a ion of p onal info pad	olaces ormation	/or English		
Langua Allocat Additic Worklo 390 h Teachin 	age of a ion of p onal info pad	ormation e	/or English		
Langua Allocat Additio Worklo 390 h Teachin Referre	age of a ion of p onal info oad ng cycl	ormation e LPOI (examination regu	/or English		
Langua Allocat Additic Worklo 390 h Teachin Referre Modulo	age of a ion of p onal info pad ng cycl ed to in	ormation e LPOI (examination regu	/or English		
Langua Allocat Additic Worklo 390 h Teachin Referre Bachel	age of a ion of p onal info pad ng cycl ed to in e appea or's de	ormation e LPO I (examination regu urs in gree (1 major) Mathemati	/or English		
Langua Allocat Additic Worklo 390 h Teachin Referre Bachel Bachel Bachel	age of a ion of p onal info pad ed to in e appea or's dep or's dep	ormation e LPOI (examination regu	/or English /or English lations for teaching-o		

Module title					Abbreviation	
Overvi	ew Geo	metric Analysis and Or	10-M-GAGD-PÜ-152-m01			
matica	l Physi	cs				
Module coordinator				Module offered by		
Dean o	f Studi	es Mathematik (Mathen	natics)	Institute of Mathen	natics	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
13	î	rical grade		• • • •		
Duratio	on	Module level	Other prerequisites			
1 seme		undergraduate				
Conten	ts		1			
licatior	ns in ve initial	ector analysis and topolo values, systems of linea	ogy; existence and uni	queness theorem; c	orms, Stoke's theorem and app- ontinuous dependence of soluti- al series, linear differential equat	
Intend	ed lear	ning outcomes				
nary di	fferent		able to relate these c	oncepts with one an	ic analysis and the theory of ordi other, and realises the advanta-	
Course	s (type	, number of weekly con	tact hours, language –	- if other than Germa	an)	
V (4) +	Ü (2)					
ster, in oral ex Assess may or den (O themat	format aminat ment v Ily be s verviev cics).	ion on whether module ion of one candidate ea vill have reference to two elected as the subject of v Mathematical Method	can be chosen to earn ch (20 to 40 minutes) o topics in pure mathe of one examination in t s) or in module group f	a bonus) matics as agreed up he sub-field Gesamt	ation offered — if not every seme bon with the examiner. Each topic tüberblick Mathematische Metho ttik (Supplementary Topics in Ma	
-		ssessment: German an	d/or English			
Allocat	ION OF	places				
Additio	nal in	ormation				
Worklo	ad					
390 h						
Teachi	ng cyc	e				
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)	
Modul	e appe	ars in				
		gree (1 major) Mathema	tical Physics (2015)			
		gree (1 major) Mathema	• -			
		gree (1 major) Mathema	•			
		gree (1 major) Mathema	•			
		<u> </u>	,,			

Module	e title				Abbreviation
Geometric Analysis					10-M-GAN-152-m01
Module coordinator				Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS		od of grading	Only after succ. com	pl. of module(s)	
9	(not) s	successfully completed			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	lts				
		in analysis on manifolds tor analysis and topology		ulus of differential fo	orms, Stoke's theorem and appli-
Intend	ed lear	ning outcomes			
		acquainted with the fun ethods to practical probl		nd methods in geom	netric analysis. He/she is able to
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	an)
V (4) +	Ü (2)				
ster, in a) writt b) oral c) oral	formati en exan examir examin age of a	ion on whether module ca mination (approx. 90 to 1 nation of one candidate e ation in groups (groups o ssessment: German and	an be chosen to earn 80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes	a bonus) chosen) or s) or	ition offered — if not every seme-
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
Worklo	ad				
270 h			,		
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	lations for teaching-c	legree programmes)	
§ 22	Nr. 3 f)				
Module	e appea	ars in			
Bachel Bachel First sta	or's de or's de ate exa or's de	gree (1 major) Mathemati gree (1 major) Mathemati gree (1 major) Computation mination for the teaching gree (1 major) Mathemati gree (1 major) Mathemati	cal Physics (2015) onal Mathematics (20 g degree Gymnasium cal Physics (2016)	-	

Module title Geometric Analysis for Mathematical Physics					Abbreviation
Geometric Analysis for Mathematical Physics					10-M-GANP-152-m01
Module coordinator				Module offered by	
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathen	natics
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites	;	
1 seme	ster	undergraduate			
Conten	ts				
		in analysis on manifolds tor analysis and topology		ulus of differential f	orms, Stoke's theorem and appli-
Intende	ed lear	ning outcomes			
		acquainted with the fun ethods to practical probl		and methods in geor	netric analysis. He/she is able to
		, number of weekly conta		- if other than Germa	an)
V (4) +		,			
Metho	d of ass				ation offered — if not every seme-
ster, in	formati	on on whether module c	an be chosen to earn	a bonus)	
					with the examiner. Each topic
themat	verview tics). age of a	elected as the subject of Mathematical Methods) ssessment: German and	one examination in t or in module group I	he sub-field Gesam	tüberblick Mathematische Metho
themat Langua	verview tics). age of a ble for	elected as the subject of / Mathematical Methods) ssessment: German and bonus	one examination in t or in module group I	he sub-field Gesam	tüberblick Mathematische Metho
themat Langua credita	verview tics). age of a ble for	elected as the subject of / Mathematical Methods) ssessment: German and bonus	one examination in t or in module group I	he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Metho- tik (Supplementary Topics in Ma-
themat Langua credita Allocat	verview cics). age of a ble for cion of j	elected as the subject of / Mathematical Methods) ssessment: German and bonus	one examination in t or in module group I	he sub-field Gesam	tüberblick Mathematische Metho
themat Langua credita Allocat	verview cics). age of a ble for cion of j	elected as the subject of / Mathematical Methods) ssessment: German and bonus blaces	one examination in t or in module group I	he sub-field Gesam	tüberblick Mathematische Metho
themat Langua credita Allocat	verview ics). age of a ble for ion of p	elected as the subject of / Mathematical Methods) ssessment: German and bonus blaces	one examination in t or in module group I	he sub-field Gesam	tüberblick Mathematische Metho
themat Langua credita Allocat Additio	verview ics). age of a ble for ion of p	elected as the subject of / Mathematical Methods) ssessment: German and bonus blaces	one examination in t or in module group I	he sub-field Gesam	tüberblick Mathematische Metho
themat Langua credita Allocat Additio Worklo	verview ics). age of a ble for ion of p onal inf	elected as the subject of Mathematical Methods) ssessment: German and bonus places	one examination in t or in module group I	he sub-field Gesam	tüberblick Mathematische Metho
themat Langua credita Allocat Additio Worklo 300 h	verview ics). age of a ble for ion of p onal inf	elected as the subject of Mathematical Methods) ssessment: German and bonus places	one examination in t or in module group I	he sub-field Gesam	tüberblick Mathematische Metho
themat Langua credita Allocat Additio 300 h Teachin 	verview ics). age of a ble for ion of p onal inf pad	elected as the subject of Mathematical Methods) ssessment: German and bonus places	one examination in t or in module group I /or English	he sub-field Gesamt Ergänzung Mathema	tüberblick Mathematische Metho Itik (Supplementary Topics in Ma
themat Langua credita Allocat Additio 300 h Teachin 	verview ics). age of a ble for ion of p onal inf pad	elected as the subject of Mathematical Methods) ssessment: German and bonus blaces ormation e	one examination in t or in module group I /or English	he sub-field Gesamt Ergänzung Mathema	tüberblick Mathematische Metho Itik (Supplementary Topics in Ma-
themat Langua credita Allocat Additio 300 h Teachin 	verview ics). age of a ble for ion of p onal inf pad	elected as the subject of Mathematical Methods) ssessment: German and bonus blaces ormation e LPOI (examination regu	one examination in t or in module group I /or English	he sub-field Gesamt Ergänzung Mathema	tüberblick Mathematische Metho Itik (Supplementary Topics in Ma
themat Langua credita Allocat Additio 300 h Teachin Referre Module	verview cics). age of a ble for ion of p onal inf onal inf onal inf ead	elected as the subject of Mathematical Methods) ssessment: German and bonus blaces ormation e LPOI (examination regu	one examination in t or in module group l /or English lations for teaching-o	he sub-field Gesamt Ergänzung Mathema	tüberblick Mathematische Metho tik (Supplementary Topics in Ma
themat Langua credita Allocat Additio Worklo 300 h Teachin Referre Bachel	verview ics). age of a ble for ion of p onal inf pad ad ed to in e appea or's de	elected as the subject of Mathematical Methods) ssessment: German and bonus olaces ormation e LPO I (examination regu	one examination in t or in module group I /or English lations for teaching- cal Physics (2015)	he sub-field Gesamt Ergänzung Mathema	tüberblick Mathematische Metho tik (Supplementary Topics in Ma
themat Langua credita Allocat Additio Worklo 300 h Teachin Referre Bachel Bachel Bachel Bachel	verview ics). age of a ble for ion of p onal inf oad ad ad ad ad ad ad ad ad ad ad ad ad a	elected as the subject of Mathematical Methods) ssessment: German and bonus blaces ormation e LPO I (examination regu urs in gree (1 major) Mathemati	one examination in t or in module group I /or English lations for teaching-o ical Physics (2015) ical Physics (2016) ical Physics (2020)	he sub-field Gesamt Ergänzung Mathema	tüberblick Mathematische Metho Itik (Supplementary Topics in Ma

for Mathemati- dule offered by itute of Mathem of module(s)	10-M-GAPA-PÜ-152-m01 natics
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itute of Mathem	natics
	natics
of module(s)	
rder partial diffe	forms, Stoke's theorem and its erential equations, existence and e theorems, maximum principle
	c analysis and the theory of part her, and realises the advantages
her than Germa	n)
nus) cs as agreed up ıb-field Gesamti	tion offered — if not every seme- on with the examiner. Each topic überblick Mathematische Metho tik (Supplementary Topics in Ma
e programmes)	
ee programmes)	
e programmes)	
e programmes)	
e programmes)	
e programmes)	

Module	e title			Abbreviation	
Basic N	Notions and Methods of Math	ematical Reasoning		10-M-GBM-152-m01	
Module coordinator			Module offered by		
Dean of Studies Mathematik (Mathematics)			Institute of Mathematics		
			ipl. of module(s)	Iducs	
2	(not) successfully completed				
Duratio		Other prerequisites			
1 seme	ester undergraduate				
Conten	nts				
Introdu	uction to the basic notions and	d proof techniques in m	athematics: approa	ch to sets, formal log	gic and maps.
	ed learning outcomes	<u> </u>			
	udent gets acquainted with the chelor's degree study program		ues which are prere	quisites for the furth	er courses in
Course	es (type, number of weekly cor	ntact hours, language –	· if other than Germa	ın)	
V (1) +	Ü (1)				
	d of assessment (type, scope, Iformation on whether module	0 0		ition offered — if not	every seme-
	t (10 to 15 pages) age of assessment: German ar	nd/or English			
Allocat	tion of places				
Additic	onal information				
Additic	onal information on module du	uration: block taught pr	ior to the beginning	of the lecture period	
Worklo	bad				
60 h					
Teachi	ng cycle				
 Referre	ed to in LPO I (examination re	gulations for teaching-	legree programmes)		
	Nr. 1 h)	34.4.0.0 101 1040	<u></u>		
Modul	e appears in				
	lor's degree (1 major) Mathem	atics (2015)			
	lor's degree (1 major) Economa				
	lor's degree (1 major) Mathem	,			
	lor's degree (1 major) Computa		-	、	
	ate examination for the teaching)	
	ate examination for the teaching			,	
	ate examination for the teachi lor's degree (1 major) Mathem		mainematics (2015,)	
	lor's degree (1 major) Mathemi lor's degree (1 major) Economa	•			
	ate examination for the teaching		Mathematics (2020	(Prüfungsordnungs)	version
	lor's degree (1 major) Mathem	atical Physics (2020)			
	lor's degree (1 major) Economa				
	lor's degree (1 major) Economa				
	lor's degree (1 major) Mathem		22)		
exchan	nge program Mathematics (20)	23)			
	with 1 major Mathematical Physics		generated 18-Apr-2025 • ex r (180 ECTS) Mathematische	-	page 41 / 118
(2015)			(100 LC13) Mathematische	- 11y SIN - 2015	1

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

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) Economathematics (2025)

Modul	e title				Abbreviation
Overview Ordinary Differential Equations and Partial Differential Equation					10-M-GDPA-PÜ-152-m01
Mathe	matica	Physics			
Module coordinator				Module offered by	
Dean o	f Studi	es Mathematik (Mathe	ematics)	Institute of Mathem	natics
ECTS	Meth	od of grading	Only after succ. com	pl. of module(s)	
13		rical grade		•	
Duratio	on .	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts		•		
ferentia differen equatio	al equa ntial ec ons of I	tions, matrix exponen juations and partial di nathematical physics,	tial series, linear differen fferential equations of fi	ntial equations of hi rst order, existence	tial values, systems of linear dif- gher order; examples of partial and uniqueness theorems, basic ple and Dirichlet problem.
Intend	ed lear	ning outcomes			
tial equ	uations		ate these concepts with		ry of ordinary and partial differen- alises the advantages of thinking
Course	s (type	, number of weekly co	ntact hours, language —	if other than Germa	ın)
V (4) +	Ü (2)				
			, language — if other tha e can be chosen to earn		tion offered — if not every seme-
Assess may or den (O themat	ment v Ily be s verviev tics).	vill have reference to t elected as the subject	of one examination in th ds) or in module group E	he sub-field Gesamt	on with the examiner. Each topic überblick Mathematische Metho- tik (Supplementary Topics in Ma-
Allocat	ion of	places			
Additio	onal inf	ormation			
Worklo	ad				
390 h					
Teachi	ng cvcl	e			
	-3 -9 -0	-			
Poforre	d to in	IPOL (ovamination r	egulations for teaching-d	lagraa programmaa	
Referre				iegiee programmes)	
		···· •··			
Modul					
		gree (1 major) Mathem	• -		
		gree (1 major) Mathem			
		gree (1 major) Mathen gree (1 major) Mathen	•		
Dachel	u sue	Siee (1 major) mathem	ialical Fliysics (2024)		

Module	e title			Abbreviation			
Selecte	ed Topics in History of Mathem	atics		10-M-GES-152-m01			
Module coordinator			Module offered by				
			_				
Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s)				Idlics			
ECTS 5	Method of grading (not) successfully completed		ipi. of module(s)				
Duratio		Other prerequisites					
Conten]					
Historio the fun	cal and cultural development as damentals of mathematics, in point of mathematics in modern soci	particular in its relatio					
Intend	ed learning outcomes						
	on selected examples, the stud eories and their social relevanc ce.						
Course	s (type, number of weekly cont	act hours, language —	if other than Germa	n)			
V (2) +	Ü (2)						
	d of assessment (type, scope, la formation on whether module o			tion offered — if not	every seme-		
Langua Assess	ect work (15 to 25 hours) age of assessment: German and ment offered: In the semester i		offered and in the su	ıbsequent semester			
Allocat	ion of places						
Additio	onal information	_					
Worklo	ad						
150 h							
-	ng cycle	-					
	3 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5 -						
Poforro	ed to in LPO I (examination reg	lations for teaching	legree programmes)				
§ 22							
	e appears in	· ()					
	or's degree (1 major) Mathemat	-					
	or's degree (1 major) Mathemat or's degree (1 major) Computat	• •	245)				
			-				
First state examination for the teaching degree Gymnasium Mathematics (2015) Bachelor's degree (1 major) Mathematical Physics (2016)							
	Bachelor's degree (1 major) Mathematical Physics (2016)						
Bachel	First state examination for the teaching degree Gymnasium Mathematics (2019)						
Bachel First sta	ate examination for the teachin or's degree (1 major) Mathemat		mathematics (2019)				
Bachel First sta Bachel		ical Physics (2020)	-				
Bachel First sta Bachel Bachel	or's degree (1 major) Mathemat	ical Physics (2020) ical Data Science (202	-				
Bachel First sta Bachel Bachel exchan First sta	or's degree (1 major) Mathemat or's degree (1 major) Mathemat	ical Physics (2020) ical Data Science (202 3) g degree Gymnasium	22)				



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

Module title					Abbreviation							
Linear Algebra 1 10-M-LNA1-152-m01												
Module coordinator				Module offered by								
Dean o	of Studio	es Mathematik (Mathema	atics)	Institute of Mathem	atics							
ECTS	+	od of grading	Only after succ. com	pl. of module(s)								
8	(not) s	successfully completed										
Duratio	on	Module level	Other prerequisites									
1 seme	ester	undergraduate										
Conter	nts											
Basic r termina		and structures; vector sp	aces, linear maps, sy	stems of linear equa	ations; theory of matrices and de-							
Intend	ed learı	ning outcomes										
ted wit	h the ce	entral proof methods in li	near algebra and can	apply them to solve	ear algebra. He/She is acquain- e easy problems. He/She is able m adequately in written form.							
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)							
V (4) +	Ü (2)											
		s essment (type, scope, la on on whether module ca			tion offered — if not every seme-							
exercis Langua	ses each age of a	n) ssessment: German and,		n exercises (approx.	12 exercise sheets with approx. 4							
Allocat	tion of p	olaces										
Additio	onal inf	ormation										
Worklo	ad											
240 h												
	ng cycl	e										
	<u> </u>											
Referre	ed to in	LPOI (examination regu	lations for teaching-c	legree programmes)								
		(examination regu										
	e appea											
		gree (1 major) Mathemati	-									
		gree (1 major) Economath										
		gree (1 major) Mathemati	• -									
		gree (1 major) Computatio		015)								
		gree (1 major) Mathemati	,									
		gree (1 major) Economatł gree (1 major) Economatł										
		gree (1 major) Economatr gram Mathematics (2023)										
Bucher	51 5 uc	Siec (I major) mathemati	ر zoz (Bachelor's degree (1 major) Mathematics (2023)							

Module	e title				Abbreviation
Overvie	ew Line	ar Algebra for Mathema	tical Physics		10-M-LNP-Ü-152-m01
Module coordinator				Module offered by	
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
12	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
	inants;	eigenvalue theory; bilin			equations; theory of matrices and oaces; diagonalisability and Jor-
Intende	ed lear	ning outcomes			
ply the knows them a	m inde about t dequat	pendently. He/She has a heir algebraic and geom ely in written and oral fo	n overview over the f etric background, is a rm.	undamental notions able to relate them to	linear algebra and is able to ap- and methods of linear algebra, o each other and can present
Course	s (type	, number of weekly conta	act hours, language —	- if other than Germa	in)
V (4) +	Ü (2)				
		essment (type, scope, la on on whether module o			tion offered — if not every seme-
Assess	ment w	ion of one candidate eac vill have reference to the ssessment: German and	contents of modules	10-M-LNA-1 and 10-N	M-LNP-Ü.
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
360 h					
Teachi	ng cvcl	e			
	<u> </u>				
Referre	d to in	LPOI (examination reg	lations for teaching-	degree programmes)	
Module		urs in			
		gree (1 major) Mathemat	ical Physics (2015)		
	or's de				

Module	title			Abbreviation		
Mathem	atical Writing			10-M-MSC-152-m01		
Module coordinator			Madula afferred by			
			Module offered by			
Dean of Studies Mathematik (Mathematics) Institute of Mathematics						
	Method of grading	Only after succ. com	pl. of module(s)			
	(not) successfully completed					
Duration		Other prerequisites				
1 semes	ter undergraduate					
Content	S					
vers the compreh	ion of good and bad mathema whole range of mathematical nensive works such as Bachelo nd efficiency but also didactic	texts from short proof or's or Master's theses	s and the formulatio	on of theorems and d	efinitions to	
Intended	d learning outcomes					
	lent is able to formulate mathe e structures and conventions					
Courses	(type, number of weekly conta	act hours, language —	if other than Germa	n)		
V (2) + Ü						
	of assessment (type, scope, la	anguage — if other tha	an German. examina	tion offered — if not o	everv seme-	
	prmation on whether module c					
Languag Assessm	t work (15 to 25 hours) of assessment: German and nent offered: In the semester in	· •	offered and in the su	Ibsequent semester		
Allocatio	on of places					
Addition	al information					
Workloa	d					
150 h						
Teaching	g cycle					
Referred	I to in LPO I (examination regu	lations for teaching.	legree programmes)			
§ 22 N						
	appears in	inc (2015)				
	r's degree (1 major) Mathemat					
	r's degree (1 major) Mathemat r's degree (1 major) Computati	• -	115)			
			-			
	First state examination for the teaching degree Gymnasium Mathematics (2015) Bachelor's degree (1 major) Mathematical Physics (2016)					
	te examination for the teaching	•	Mathematics (2019)			
	r's degree (1 major) Mathemat	,				
Bachelo	r's degree (1 major) Mathemat	ical Data Science (20:	22)			
-	e program Mathematics (2023					
	te examination for the teaching r's degree (1 major) Mathemat	,	Mathematics (2023)			
Bachelor's w	ith 1 major Mathematical Physics		generated 18-Apr-2025 • exa	am reg da-	page 48 / 118	
(2015)		-	(180 ECTS) Mathematische	-	Puse 40 / 110	



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

Module title				-	Abbreviation
Modeling and Computational Science					10-M-MWR-152-m01
Module coordinator				Module offered by	
Dean o	of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS		od of grading	Only after succ. con	npl. of module(s)	
8	1	rical grade			
Duratio	on	Module level	Other prerequisites	i	
1 seme	ester	undergraduate			
Conten	nts				
scaling ons, fu	g the mo	odelling, asymptotic seri ntal methods for numeri	es, classical methods	for solving ordinary	rinciples of modelling, aspects or and partial differential equati- ns and the resulting systems of l
		ning outcomes	-		
			mathematical method	ds and techniques to	o simulate processes from natur
		ng sciences on a comput			
Course	es (type	, number of weekly conta	act hours, language –	- if other than Germa	in)
V (4) +					
Modul	e taugh	t in: German and/or Engl	lish		
		sessment (type, scope, la ion on whether module c			tion offered — if not every seme
		mination (approx. 90 to 1 nation of one candidate e			
b) oral c) oral Langua credita	examir examin age of a ible for	nation of one candidate e ation in groups (groups of ssessment: German and bonus	each (15 to 30 minute of 2, 10 to 15 minutes	s) or	
b) oral c) oral Langua credita	examir examin age of a	nation of one candidate e ation in groups (groups of ssessment: German and bonus	each (15 to 30 minute of 2, 10 to 15 minutes	s) or	
b) oral c) oral Langua credita Allocat	examir examin age of a ible for t ion of j	nation of one candidate e lation in groups (groups o ssessment: German and bonus blaces	each (15 to 30 minute of 2, 10 to 15 minutes	s) or	
b) oral c) oral Langua credita Allocat	examir examin age of a ible for t ion of j	nation of one candidate e ation in groups (groups of ssessment: German and bonus	each (15 to 30 minute of 2, 10 to 15 minutes	s) or	
b) oral c) oral Langua credita Allocat Additic	examir examin age of a ble for tion of p	nation of one candidate e lation in groups (groups o ssessment: German and bonus blaces	each (15 to 30 minute of 2, 10 to 15 minutes	s) or	
b) oral c) oral Langua credita Allocat Additic Worklo	examir examin age of a ble for tion of p	nation of one candidate e lation in groups (groups o ssessment: German and bonus blaces	each (15 to 30 minute of 2, 10 to 15 minutes	s) or	
b) oral c) oral Langua credita Allocat Additic Worklo 240 h	examir examin age of a ble for tion of p onal inf	nation of one candidate e lation in groups (groups of ssessment: German and bonus blaces ormation	each (15 to 30 minute of 2, 10 to 15 minutes	s) or	
b) oral c) oral Langua credita Allocat Additic Worklo 240 h	examir examin age of a ble for tion of p	nation of one candidate e lation in groups (groups of ssessment: German and bonus blaces ormation	each (15 to 30 minute of 2, 10 to 15 minutes	s) or	
b) oral c) oral Langua credita Allocat Worklo 240 h Teachin 	examir examin age of a ble for tion of p onal inf pad	e	each (15 to 30 minutes of 2, 10 to 15 minutes /or English	s) or per candidate)	
b) oral c) oral Langua credita Allocat Worklo 240 h Teachin 	examir examin age of a ble for tion of p onal inf pad	nation of one candidate e lation in groups (groups of ssessment: German and bonus blaces ormation	each (15 to 30 minutes of 2, 10 to 15 minutes /or English	s) or per candidate)	
b) oral c) oral Langua credita Allocat Worklo 240 h Teachi Referre	examin examin age of a ble for tion of p tion of p onal inf oad ng cycl ed to in	e LPOI (examination regu	each (15 to 30 minutes of 2, 10 to 15 minutes /or English	s) or per candidate)	
b) oral c) oral Langua credita Allocat Additio 240 h Teachin Referre Modulo	examin examin age of a able for tion of p onal inf oad ng cycl ed to in e appea	ation of one candidate e ation in groups (groups of ssessment: German and bonus olaces ormation e LPO I (examination regu	each (15 to 30 minutes of 2, 10 to 15 minutes /or English 	s) or per candidate)	
b) oral c) oral Langua credita Allocat Additio 240 h Teachin Referre Bachel	examir examin age of a ble for tion of p onal inf oad ng cycl ed to in e appea or's de	e LPOI (examination regulars in gree (1 major) Physics (2	each (15 to 30 minutes of 2, 10 to 15 minutes /or English 	s) or per candidate)	
b) oral c) oral Langua credita Allocat Morklo 240 h Teachi Referre Bachel Bachel Bachel	examin examin age of a ble for tion of p onal inf oad ng cycl ed to in e appea lor's de or's de	e LPO I (examination regulars ars in gree (1 major) Physics (2- gree (1 major) Mathemat	each (15 to 30 minutes of 2, 10 to 15 minutes /or English 	s) or per candidate) degree programmes)	
b) oral c) oral Langua credita Allocat Additic 240 h Teachin Referre Bachel Bachel Bachel Bachel	examin examin age of a ble for tion of p onal inf oad ng cycl ed to in e appea lor's de lor's de	e LPO I (examination regulars in gree (1 major) Physics (2	each (15 to 30 minutes of 2, 10 to 15 minutes /or English 	s) or per candidate) degree programmes)	
b) oral c) oral Langua credita Allocat Additio 240 h Teachin Referre Bachel Bachel Bachel Bachel Bachel	examin examin age of a able for tion of p onal inf oad ng cycl ed to in e appea lor's de lor's de lor's de	e LPO I (examination regulars in gree (1 major) Physics (2 gree (1 major) Computati	each (15 to 30 minutes of 2, 10 to 15 minutes /or English 	s) or per candidate) degree programmes)	
b) oral c) oral Langua credita Allocat Modditic 240 h Teachi Referre Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel	examin examin age of a ble for tion of j bnal inf bad ng cycl ed to in e appea lor's de lor's de lor's de lor's de lor's de lor's de	e LPO I (examination regulars in gree (1 major) Physics (2 gree (1 major) Mathemat gree (1 major) Mathemat gree (1 major) Mathemat	each (15 to 30 minutes of 2, 10 to 15 minutes /or English 	s) or per candidate) degree programmes)	

Module title					Abbreviation	
Numerical Mathematics 1 for Mathematical Physics					10-M-NUM1P-152-m01	
Module coordinator				Module offered by		
Dean o	of Studi	es Mathematik (Mathem	atics)	Institute of Mathen	natics	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	undergraduate				
Conter	nts					
		stems of linear equation tion with polynomials, s			quations and systems of equati- rical integration.	
Intend	ed lear	ning outcomes				
		acquainted with the fur oblems and knows abou			erical mathematics, applies them	
Course	es (type	, number of weekly cont	act hours, language –	- if other than Germa	an)	
V (4) +	Ü (2)					
		sessment (type, scope, la ion on whether module o			ation offered — if not every seme-	
b) oral c) oral Langua	examir examin	mination (approx. 90 to nation of one candidate o ation in groups (groups ssessment: German anc bonus	each (15 to 30 minute of 2, 10 to 15 minutes	s) or		
Allocat	tion of _l	olaces				
Additio	onal inf	ormation				
Worklo	oad					
300 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes))	
Modul	e appea	ars in				
		gree (1 major) Mathemat	tical Physics (2015)			
		gree (1 major) Mathemat	,			
		gree (1 major) Mathemat				
		gree (1 major) Mathemat	•			

Module title					Abbreviation
Numerical Mathematics 2 for Mathematical Physics			atical Physics		10-M-NUM2P-152-m01
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mather	natics
ECTS		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				
		oblems, linear programm ıe problems.	ing, methods for initi	al value problems f	or ordinary differential equations
Intend	ed lear	ning outcomes			
about t	heir ad		concerning the poss		erical mathematics and knows on in different fields of natural
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	an)
V (4) +	Ü (2)				
		sessment (type, scope, la ion on whether module ca			ation offered — if not every seme
b) oral c) oral	examir examin Ige of a	mination (approx. 90 to 1 nation of one candidate e nation in groups (groups o ssessment: German and bonus	ach (15 to 30 minutes of 2, 10 to 15 minutes	s) or	
Allocat	ion of _l	places			
Additio	onal inf	ormation			
Worklo	ad				
300 h					
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	lations for teaching-o	legree programmes)
			0		
Module	e appea	ars in			
		gree (1 major) Mathemati	cal Physics (2015)		
Bachel		, ,	Cut i i y 51C5 (201)/		
	or's de	gree (1 major) Mathemati	,		
Bachel Bachel	or's de	gree (1 major) Mathemati gree (1 major) Mathemati gree (1 major) Mathemati	cal Physics (2016) cal Physics (2020)		

Module title					Abbreviation
Operat	ions Re	esearch for Mathematica	l Physics		10-M-ORSP-152-m01
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Linear	prograr	nming, duality theory, tra	ansport problems, int	egral linear program	ming, graph theoretic problems.
Intend	ed lear	ning outcomes			
for solv	ing ma		pecially in economics		h, as required as a central tool apply these methods to practical
Course	s (type	, number of weekly conta	act hours, language —	· if other than Germa	an)
V (4) +	Ü (2)				
		sessment (type, scope, la ion on whether module c			tion offered — if not every seme-
b) oral c) oral Langua	examir examin Ige of a ment o	mination (approx. 90 to 1 nation of one candidate e ation in groups (groups of ssessment: German and ffered: In the semester ir bonus	each (15 to 30 minutes of 2, 10 to 15 minutes /or English	5) or per candidate)	ubsequent semester
Allocat	ion of _l	olaces			
Additio	onal inf	ormation			
 Worklo	ad				
300 h					
Teachi	ng cvcl	e			
Referre	ed to in	LPOI (examination regu	llations for teaching-o	legree programmes)	
Module	e appea	ars in			

Module title Abbreviation							
Introduction to Partial Differential Equations					10-M-PAR-152-m01		
Madula		luntor.		Madula offered by			
Module				Module offered by			
		es Mathematik (Mathema	-	Institute of Mathem	natics		
ECTS		od of grading	Only after succ. com	ipl. of module(s)			
9	<u> </u>	successfully completed					
Duratio		Module level	Other prerequisites				
1 seme		undergraduate					
Conten							
					rst order, existence and uniquen-		
ess the richlet		•	ematical physics, bo	undary value proble	ms, maximum principle and Di-		
		ning outcomes					
			domontal concents -	اء - جاء شما مراج الم	a a nu of montial differential a sur-		
		is able to apply these me			neory of partial differential equa-		
		, number of weekly conta	· · · ·		n)		
V (4) +			ct nours, language –				
	· · · · ·						
		on on whether module ca			tion offered — if not every seme-		
a) writt	en exai	nination (approx. 90 to 1	80 minutes, usually (chosen) or			
		ation of one candidate e					
		ation in groups (groups o		per candidate)			
		ssessment: German and, ffered: In the semester ir		offered and in the cu	ub coquent competer		
credita			i willen the course is	onered and in the st	ibsequent semester		
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad		,				
270 h							
Teachi	ng cycl	e					
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	e appea	ins in					
Bachel	or's de	gree (1 major) Mathemati	cs (2015)				
		gree (1 major) Mathemati	• -				
		gree (1 major) Computati		015)			
		gree (1 major) Mathemati	•				
Bachel	or's de	gree (1 major) Mathemati	cs (2023)				

	e title				Abbreviation
Introduction to Partial Differential Equations for Mathemat				ical Physics	10-M-PARP-152-m01
Modul	e coord	inator		Module offere	d by
Dean o	of Studi	es Mathematik (Mathema	atics)	Institute of Ma	thematics
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ester	undergraduate			
Conter	nts				
ess the		, basic equations of math			s of first order, existence and unique roblems, maximum principle and Di-
Intend	ed lear	ning outcomes			
		acquainted with the fun is able to apply these me			the theory of partial differential equa
Course	s (type	, number of weekly conta	act hours, language –	- if other than G	ierman)
V (4) +	Ü (2)				
Metho	d of ass	sessment (type, scope, la	anguage — if other th	an German, exa	mination offered — if not every sem
ster, in	formati	ion on whether module c	an be chosen to earn	a bonus)	
Assess	ment w	nation in groups of 2 cano vill have reference to a to	pic in pure mathemat	ıtes each) tics as agreed ι	pon with the examiner. Each topic samtüberblick Mathematische Meth
Assess may or den (O themat Langua Assess	ment w nly be s verview tics). age of a	nation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester ir	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English	utes each) tics as agreed u he sub-field Ge Ergänzung Matl	ipon with the examiner. Each topic samtüberblick Mathematische Meth iematik (Supplementary Topics in M the subsequent semester
Assess may or den (O themat Langua Assess credita	sment w nly be s verview tics). age of a sment o	nation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester ir bonus	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English	utes each) tics as agreed u he sub-field Ge Ergänzung Matl	samtüberblick Mathematische Meth nematik (Supplementary Topics in M
Assess may or den (O themat Langua Assess credita	ment w nly be s verview tics). age of a ment o ble for	nation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester ir bonus	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English	utes each) tics as agreed u he sub-field Ge Ergänzung Matl	samtüberblick Mathematische Meth nematik (Supplementary Topics in M
Assess may or den (O themat Langua Assess credita Allocat	ment w nly be s verview tics). age of a sment o ble for t ion of j	nation in groups of 2 cano vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester ir bonus	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English	utes each) tics as agreed u he sub-field Ge Ergänzung Matl	samtüberblick Mathematische Meth nematik (Supplementary Topics in M
Assess may or den (O themat Langua Assess credita Allocat	ment w nly be s verview tics). age of a sment o ble for t ion of j	nation in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester ir bonus blaces	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English	utes each) tics as agreed u he sub-field Ge Ergänzung Matl	samtüberblick Mathematische Meth nematik (Supplementary Topics in M
Assess may or den (O themat Langua Assess credita Allocat	ment w nly be s verview tics). age of a sment o ble for tion of p	nation in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester ir bonus blaces	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English	utes each) tics as agreed u he sub-field Ge Ergänzung Matl	samtüberblick Mathematische Meth nematik (Supplementary Topics in M
Assess may or den (O themat Langua Assess credita Allocat Additic	ment w nly be s verview tics). age of a sment o ble for tion of p	nation in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester ir bonus blaces	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English	utes each) tics as agreed u he sub-field Ge Ergänzung Matl	samtüberblick Mathematische Meth nematik (Supplementary Topics in M
Assess may or den (O themat Langua Assess credita Allocat Additio Worklo 300 h	ment w nly be s verview tics). age of a sment o ble for tion of p	nation in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester in bonus blaces	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English	utes each) tics as agreed u he sub-field Ge Ergänzung Matl	samtüberblick Mathematische Meth nematik (Supplementary Topics in M
Assess may or den (O themat Langua Assess credita Allocat Additio Worklo 300 h	ment w nly be s verview tics). age of a ment o ble for tion of p onal inf	nation in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester in bonus blaces	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English	utes each) tics as agreed u he sub-field Ge Ergänzung Matl	samtüberblick Mathematische Meth nematik (Supplementary Topics in M
Assess may or den (O themat Langua Assess credita Allocat Additio 300 h Teachi 	ment w nly be s verview tics). age of a ment o ble for tion of j onal inf	nation in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester in bonus blaces	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English n which the course is	utes each) tics as agreed u he sub-field Ge Ergänzung Matl offered and in t	samtüberblick Mathematische Meth nematik (Supplementary Topics in M che subsequent semester
Assess may or den (O themat Langua Assess credita Allocat Additio 300 h Teachi 	ment w nly be s verview tics). age of a ment o ble for tion of j onal inf	ation in groups of 2 cane vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester in bonus blaces ormation	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English n which the course is	utes each) tics as agreed u he sub-field Ge Ergänzung Matl offered and in t	samtüberblick Mathematische Meth nematik (Supplementary Topics in M che subsequent semester
Assess may or den (O themat Langua Assess credita Allocat Additio 300 h Teachi Referro 	ment w nly be s verview tics). age of a ment o ble for tion of j onal inf	e LPOI (examination regu	didates (10 to 15 minu pic in pure mathemat one examination in t) or in module group I /or English n which the course is	utes each) tics as agreed u he sub-field Ge Ergänzung Matl offered and in t	samtüberblick Mathematische Meth nematik (Supplementary Topics in M che subsequent semester
Assess may or den (O themat Langua Assess credita Allocat Additic Worklc 300 h Teachi Referre Module	ment w nly be s verview tics). age of a sment o ble for tion of p onal inf onal inf onal inf ead to in	ation in groups of 2 cane vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester in bonus blaces ormation e LPOI (examination regu	didates (10 to 15 minu pic in pure mathemation one examination in t) or in module group f /or English n which the course is	utes each) tics as agreed u he sub-field Ge Ergänzung Matl offered and in t	samtüberblick Mathematische Meth nematik (Supplementary Topics in M che subsequent semester
Assess may or den (O themat Langua Assess credita Allocat Additio 300 h Teachi Referro Bachel	ment willy be s verview tics). age of a ment o ble for tion of p onal inf onal inf oad ad ed to in e appea or's de	action in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester ir bonus blaces ormation e LPOI (examination regu	didates (10 to 15 minu pic in pure mathemation one examination in t) or in module group I /or English n which the course is lations for teaching-out ical Physics (2015)	utes each) tics as agreed u he sub-field Ge Ergänzung Matl offered and in t	samtüberblick Mathematische Meth nematik (Supplementary Topics in M che subsequent semester
Assess may or den (O themat Langua Assess credita Allocat Additic Worklo 300 h Teachi Referre Bachel Bachel Bachel Bachel	ment willy be s verview tics). age of a ment o ble for tion of f onal inf onal inf oad ad ad ad ad ad ad ad ad ad ad ad ad a	action in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and ffered: In the semester in bonus blaces ormation e LPO I (examination regunnant gree (1 major) Mathemation	didates (10 to 15 minu pic in pure mathemation one examination in t) or in module group I /or English n which the course is ulations for teaching-out ical Physics (2015) ical Physics (2016) ical Physics (2020)	utes each) tics as agreed u he sub-field Ge Ergänzung Matl offered and in t	samtüberblick Mathematische Meth nematik (Supplementary Topics in M che subsequent semester

Module title					Abbreviation
Introduction to Projective Geometry for Mathematical Physics 10-M-PGEP-152-mo1					10-M-PGEP-152-m01
Modul	e coord	linator		Module offered by	•
Dean o	of Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	nts				
		d affine planes, projectives, dualities and polarities			s, fundamental theorems for pro-
Intend	ed lear	ning outcomes			
		s acquainted with the fur nethods to practical prob		nd methods of proje	ective geometry. He/she is able to
Course	es (type	, number of weekly conta	act hours, language –	- if other than Germa	an)
V (4) +		· · · · ·			
c) oral Langua	examir age of a sment o ble for		of 2, 10 to 15 minutes /or English	per candidate)	ubsequent semester
Additic	nal inf	ormation			
Audith	- nat nii				
Worklo					
	au				
300 h Teachi	ng avel	0			
reacili	ing cycl	e	_		
			dette no forster shi	d ``````````````````````````````	
Keferre	ea to in	LPOI (examination regu	liations for teaching-	uegree programmes)	
Module					
		gree (1 major) Mathemat	,		
		gree (1 major) Mathemat gree (1 major) Mathemat	,		
		gree (1 major) Mathemat	•		

Module	title			Abbreviation		
Programming course for students of Mathematics and other subjects				10-M-PRG-152-m01		
	coordinator		Module offered by			
	Studies Mathematik (Mather		Institute of Mathem	natics		
	Method of grading	Only after succ. con	pl. of module(s)			
3	(not) successfully completed					
Duratio		Other prerequisites				
1 semes	ster undergraduate					
Content	s					
Basics o	of a modern programming lan	guage (e. g. C).				
Intende	d learning outcomes					
	dent is able to work independ	ently on small program	ming exercises and	standard programm	ing problems	
	ematics.			otaniaana programmi		
Courses	(type, number of weekly con	tact hours. language –	· if other than Germa	n)		
P (2)						
	of assessment (type, scope,	languago if other the	an Corman, ovamina	tion offered if not	00000 60000	
	ormation on whether module			ition offered — If not	every seme-	
	in the form of programming e					
	ge of assessment: German an		25 flours)			
	nent offered: Once a year, su					
	on of places					
	1.6 0					
Addition	nal information					
Workloa	ad					
90 h						
Teachin	g cycle					
Referred	d to in LPO I (examination reg	ulations for teaching-	legree programmes)			
§ 22 N		<u></u>	203.00 p.03.000)			
	appears in					
	or's degree (1 major) Mathema or's degree (1 major) Physics (-				
	or's degree (1 major) Physics (or's degree (1 major) Nanostru		-)			
	or's degree (1 major) Kanostru or's degree (1 major) Economa					
	or's degree (1 major) Economa					
	or's degree (1 major) Mathemator	• •	245)			
	,					
	Bachelor's degree (1 major) Functional Materials (2015) First state examination for the teaching degree Gymnasium Mathematics (2015)					
Bachelor's degree (1 major) Mathematical Physics (2016)						
Bachelor's degree (1 major) Economathematics (2017)						
First state examination for the teaching degree Gymnasium Mathematics (2019)						
Bachelor's degree (1 major) Physics (2020)						
	Bachelor's degree (1 major) Nanostructure Technology (2020)					
	Bachelor's degree (1 major) Mathematical Physics (2020)					
	or's degree (1 major) Function	•				
	or's degree (1 major) Quantum					
Bachelor's w	vith 1 major Mathematical Physics	JMU Würzburg •	generated 18-Apr-2025 • ex	am. reg. da-	page 57 / 118	
(2015)		ta record Bachelo	r (180 ECTS) Mathematische	Physik - 2015		

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					Abbreviation	
Prosem	inar M	athematics			10-M-PRO-152-m01	
Module	coord	inator		Module offered by	<u> </u>	
		es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS		od of grading	Only after succ. com			
4		successfully completed				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Selecte	d basi	topics in mathematics.				
		ning outcomes				
of a giv ly in a s	en topi scientif	c using selected literatur ic discussion.	e, and prepares a tal	k on the subject. He	sters elaboration and structuring /She is able to participate active-	
Course: S (2)	s (type	, number of weekly conta	ct nours, language —	I other than Germa	in)	
ster, in talk (60	formati to 120	eessment (type, scope, la on on whether module ca minutes) ssessment: German and,	an be chosen to earn		tion offered — if not every seme-	
Assess Allocat		ffered: In the semester in	which the course is	offered		
πιισται		naces				
Additio	nal inf	ormation				
Auuitio						
Worklo						
	au					
120 h		•				
Teachir	ig cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
		•				
Module appears in						
Bachelo Bachelo Bachelo Bachelo exchan Bachelo	Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Mathematical Physics (2020) exchange program Mathematics (2023) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)					

Module					Abbreviation	
School Mathematics from a Higher Perspective			rspective		10-M-SCH-152-m01	
Module	e coord	inator		Module offered by		
		es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS		od of grading	Only after succ. con			
5		successfully completed		•		
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
		selected topics in schoo implementation at both s			ation into wider theories and	
Intend	ed lear	ning outcomes				
	vancec	I mathematical theories.			between school mathematics athematical, didactical and me-	
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	in)	
V (2) +	Ü (2)					
		s essment (type, scope, la ion on whether module c			tion offered — if not every seme-	
	ment o	ssessment: German and ffered: In the semester ir places		offered and in the s	ubsequent semester	
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cvcl	e				
	0.7					
Referre	ed to in	LPOI (examination regu	llations for teaching-	degree programmes)		
§ 22						
§ 22	Nr. 2 f)					
§ 22						
Module						
		gree (1 major) Mathemat				
	Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Computational Mathematics (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 Realschule Mathematics (2015) First state examination for the teaching degree Gymnasium Mathematics (2015)						
FIRST ST	First state examination for the teaching degree Gymnasium Mathematics (2015)					
First sta	First state examination for the teaching degree Mittelschule Mathematics (2015) Bachelor's degree (1 major) Mathematical Physics (2016)					
First sta Bachel	or's de	mination for the teaching	g degree Mittelschule ical Physics (2016)	Mathematics (2015))	



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)

Bachelor's with 1 major Mathematical Physics (2015)

Module title Abbreviation					Abbreviation	
Supplementary Seminar Mathematics 10-M-SEM2-152-m01					10-M-SEM2-152-m01	
Module	Module coordinator Module offered by					
		es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS		od of grading	Only after succ. com			
4		successfully completed				
Duratio		Module level	Other prerequisites			
1 seme		undergraduate				
Conten	ts		<u>.</u>			
A selec	ted top	oic in mathematics.				
		ning outcomes				
of a giv	en top				sters elaboration and structuring /She is able to participate active-	
Course	s (type	, number of weekly conta	ct hours, language —	· if other than Germa	in)	
S (2)						
ster, in talk (60	formati	o minutes) sessment: German and,	an be chosen to earn		tion offered — if not every seme-	
Allocat	ion of _l	olaces				
Additio	nal inf	ormation				
Worklo	ad					
120 h						
Teachir	ng cvcl	e				
	<u> </u>					
Referre	d to in	LPOI (examination regu	lations for teaching-o	legree programmes)		
Module	appea	ars in				
	Bachelor's degree (1 major) Mathematics (2015)					
	Bachelor's degree (1 major) Mathematical Physics (2015)					
Bachel	Bachelor's degree (1 major) Computational Mathematics (2015)					
		gree (1 major) Mathemati	-			
Bachel	Bachelor's degree (1 major) Mathematical Physics (2020)					
Bachel	or's de	gree (1 major) Mathemati	cal Data Science (20:	22)		
		gree (1 major) Mathemati	-			
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2024)			

Modul					Abbreviation	
Stochastics 1 for Mathematical Physics			5		10-M-STO1P-152-m01	
Modul	e coord	inator		Module offered by		
Dean o	of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Meth	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	nts					
continu chastic	uous di : indep	stributions: normal distri	bution, random varia ditional probability, o	ble, distribution fun characteristics of dis	asure and integration theory, action, product measures and sto stributions: expected value and	
Intend	ed lear	ning outcomes				
		acquainted with fundam lems and knows about th			ics, applies these methods to	
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	an)	
V (4) +	Ü (2)					
a) writt b) oral c) oral Langua	en exa examir examir	ion on whether module ca mination (approx. 90 to 1 nation of one candidate e ation in groups (groups o ssessment: German and, bonus	80 minutes, usually o ach (15 to 30 minutes of 2, 10 to 15 minutes	chosen) or 5) or		
Allocat	tion of	olaces				
Additic	onal inf	ormation				
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination regu	lations for teaching-c	legree programmes))	
Module	e appea	ars in				
		gree (1 major) Mathemati	cal Physics (2015)			
			• -			
	Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Mathematical Physics (2020)					
	achelor's degree (1 major) Mathematical Physics (2020) achelor's degree (1 major) Mathematical Physics (2024)					

Module title					Abbreviation	
Stochastics 2 for Mathematical Physics 10-M-STO2P-152-mo1					10-M-STO2P-152-m01	
Module	e coord	inator		Module offered by	<u> </u>	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathen	natics	
ECTS	Methe	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Elemen	nts of d	ata analysis, statistics of	data in normal and c	other distributions, e	elements of multivariate statistics	
Intende	ed lear	ning outcomes				
		acquainted with fundam and knows about the ty			s, applies these methods to prac-	
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	an)	
V (4) +						
b) oral c) oral c Langua credita Allocat Additio	examir examir ige of a ble for ion of p onal inf		ach (15 to 30 minute of 2, 10 to 15 minutes	s) or		
Worklo	ad					
300 h						
Teachi	ng cycl	e				
Referre	d to in	LPOI (examination regu	lations for teaching-	degree programmes)		
Module	e appea	ars in				
		gree (1 major) Mathemati				
		gree (1 major) Mathemati	· · ·			
		gree (1 major) Mathemati				
Bachel	or's de	gree (1 major) Mathemati	ical Physics (2024)			

Module title				Abbreviation			
Introduction to Topology 10-M-TOP-152-mo1							
Module coordinator				Module offered by			
		es Mathematik (Mathema	, , , , , , , , , , , , , , , , , , ,	Institute of Mathem	natics		
ECTS		od of grading	Only after succ. com	pl. of module(s)			
5		successfully completed					
Duratio		Module level	Other prerequisites				
1 seme		undergraduate					
Conten	ts						
les and compa	l consti ctness,	ructions of topological sp	aces, quotients, conv	vergence of sequence	properties, connectivity, examp- es and nets, different notions of aß, Arzela-Ascoli and Baire, and		
Intende	ed lear	ning outcomes	,				
is able	to app		gebra and analysis to		as the pertinent proof methods, ses the broad applicability of the		
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)		
V (2) +	Ü (2)						
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-		
b) oral c) oral Langua	examir examin age of a ment o	mination (approx. 90 to 1 nation of one candidate e nation in groups (groups c ssessment: German and, ffered: In the semester in bonus	ach (15 to 30 minutes of 2, 10 to 15 minutes /or English	6) or per candidate)	ıbsequent semester		
Allocat	ion of _l	places					
Additio	onal inf	ormation					
Worklo	ad		,				
150 h							
Teachi	ng cycl	e					
Referred to in LPO I (examination regulations for teaching-degree programmes)							
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) Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)							
васпе	or s de	gree (1 major) Mathemati	cal Physics (2024)				

Bachelor's with 1 major Mathematical Physics	
(2015)	

Module	e title			Abbreviation			
Exercis	e tutor or proof-reading in Ma	athematics		10-M-TuKo-152-mo1			
Module coordinator			Madula offered by				
			Module offered by				
	Institute of Mathematics Method of grading Only after succ. compl. of module(s)						
			npl. of module(s)				
5	(not) successfully completed						
Duratio		Other prerequisites	Other prerequisites				
1 seme							
Conten							
	g or grading homework for on pervision of the respective lec			eaching degree prog	rammes un-		
Intende	ed learning outcomes						
	dent is able to support the ac es in mathematical proof exer			edge. He/She helps	to identify		
	s (type, number of weekly cor	· · · · ·		n)			
T (0))			
	l of according to the second	languaga if athor th	an Carman, avamina	tion offered if not	0100100000		
ster, in	d of assessment (type, scope, formation on whether module	can be chosen to earn	a bonus)		-		
	ment of tutoring activities or on nits or approx. 5 pieces of co		ervising lecturers or e	exercise supervisors	(1 to 2 tea-		
Allocat	ion of places						
Additio	nal information						
	direct application to teaching	coordinator Mathemat	tics, he/she will sele	ct participants.			
Worklo	··						
150 h							
-							
Teachin	ng cycle						
Referre	d to in LPO I (examination re	gulations for teaching-	degree programmes)				
§ 22	Nr. 3 f)						
Module	e appears in						
	or's degree (1 major) Mathem						
	or's degree (1 major) Econom						
	or's degree (1 major) Mathem		`				
	or's degree (1 major) Computa						
	ate examination for the teaching of teaching o	,	Mathematics (2015)				
	or's degree (1 major) Mathem or's degree (1 major) Econom	•					
Bachelor's degree (1 major) Economathematics (2017) First state examination for the teaching degree Gymnasium Mathematics (2019)							
Bachelor's degree (1 major) Mathematical Physics (2020)							
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	with 1 major Mathematical Physics	-	generated 18-Apr-2025 • exa or (180 ECTS) Mathematische	-	page 66 / 118		



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			
Advanced Analysis 10-M-VAN-152-mo1								
Module coordinator				Module offered by				
Dean of Studies Mathematik (Mathema		atics)	Institute of Mathem	atics				
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)				
7	nume	rical grade						
Duratio	on	Module level	Other prerequisites					
1 seme	ster	undergraduate						
Conter	Its							
Contin	uation	of analysis in several vari	ables, integration the	eorems.				
Intend	ed lear	ning outcomes						
		acquainted with advanc understand the construct			of the Lesbegue integral, he or			
		, number of weekly conta			n)			
V (4) +					,			
	-	essment (type scope la	nguage — if other the	an German, examina	tion offered — if not every seme-			
		on on whether module ca						
b) oral c) oral Langua	examir examin	mination (approx. 90 to 1 nation of one candidate e ation in groups (groups c ssessment: German and/ bonus	ach (15 to 30 minutes of 2, 10 to 15 minutes	s) or				
Allocat	ion of p	olaces						
Additio	onal inf	ormation						
Worklo	ad							
210 h								
Teachi	ng cycl	e						
	0 .)	-						
Referre	ed to in	LPOI (examination regu	lations for teaching-	legree programmes)				
				<u> </u>				
Modul	e appea	urs in						
		gree (1 major) Mathemati	(2015)					
		gree (1 major) Mathemati	-					
	Bachelor's degree (1 major) Computational Mathematics (2015)							
Bachelor's degree (1 major) Mathematical Physics (2016)								
Master's degree (1 major) Physics (2016)								
	Master's degree (1 major) Nanostructure Technology (2016)							
	-	ee (1 major) Nanostructur						
	-	ee (1 major) Physics (202						
	-	ee (1 major) Physics Inter						
		ee (1 major) Quantum Eng						
1		ee (1 major) Quantum Tec gree (1 major) Mathemati						
Dachel	Bachelor's degree (1 major) Mathematics (2023)							

	e title				Abbreviation
E-Learning and Blended Learning Mathematics 1					10-M-VHB1-152-m01
Module coordinator					
· · · · · · · · · · · · · · · · · · ·				Module offered by	
	an of Studies Mathematik (Mathema				
ECTS		od of grading	Only after succ. con	npl. of module(s)	
2		successfully completed			
Duratio	-	Module level	Other prerequisites		
1 seme		undergraduate			
Conter	nts				
Becom	ing fan	niliar with and reflecting t	echniques in e-learn	ing and blended lea	rning in mathematics.
Intend	ed lear	ning outcomes			
The stu	udent is	able to employ basic me	ethods of e-learning a	and blended learning	g in mathematics-
		, number of weekly conta	-		
Ü (2)		, namber of weekly conte			,
• •	e type: e	eLearning, mostly Virtuell	e Hochschule Bavern	ı (vhb)	
			-		tion offered — if not every seme-
		ion on whether module c			alon onered — If not every seme-
project	t (web-l	based, 15 to 20 hours)			
		offered: Once a year, wint	er semester		
Allocat	tion of	places			
	-				
Additic	onal inf	ormation			
Auuiin		ormation			
Worklo					
60 h			-		
	ng cycl	e			
reactin	ing cyce				
Deferm		IDOI (avamination ran	lationa fortoo abina		
	ed to in	LPOI (examination regu	llations for teaching-	degree programmes)	
			llations for teaching-o	degree programmes)	
 Modul	e appea	ars in		degree programmes)	
 Modul Bachel	e appe a lor's de	ars in gree (1 major) Mathemat	ics (2015)	degree programmes)	
 Modul Bachel Bachel	e appea lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economatl	ics (2015) hematics (2015)	degree programmes)	
 Modul Bachel Bachel Bachel	e appea lor's de lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat	ics (2015) hematics (2015) ical Physics (2015)		•
 Modul e Bachel Bachel Bachel Bachel	e appe a lor's de lor's de lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat gree (1 major) Computati	ics (2015) hematics (2015) ical Physics (2015) onal Mathematics (20)
 Modul Bachel Bachel Bachel Bachel Bachel	e appe a lor's de lor's de lor's de lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat gree (1 major) Computati gree (1 major) Mathemat	ics (2015) hematics (2015) ical Physics (2015) onal Mathematics (20 ical Physics (2016)		,
 Bachel Bachel Bachel Bachel Bachel Bachel	e appea lor's de lor's de lor's de lor's de lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economat gree (1 major) Mathemat gree (1 major) Computati gree (1 major) Mathemat gree (1 major) Economat	ics (2015) hematics (2015) ical Physics (2015) onal Mathematics (20 ical Physics (2016) hematics (2017)		•
 Modul Bachel Bachel Bachel Bachel Bachel Bachel	e appe a lor's de lor's de lor's de lor's de lor's de lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat gree (1 major) Computati gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat	ics (2015) hematics (2015) ical Physics (2015) onal Mathematics (20 ical Physics (2016) hematics (2017) ical Physics (2020)		
 Modul Bachel Bachel Bachel Bachel Bachel Bachel Bachel	e appea lor's de lor's de lor's de lor's de lor's de lor's de lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat gree (1 major) Computati gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat gree (1 major) Economatl	ics (2015) hematics (2015) ical Physics (2015) onal Mathematics (20 ical Physics (2016) hematics (2017) ical Physics (2020) hematics (2021)		
 Modul Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel	e appea lor's de lor's de lor's de lor's de lor's de lor's de lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat gree (1 major) Computati gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Economatl	ics (2015) hematics (2015) ical Physics (2015) onal Mathematics (20 ical Physics (2016) hematics (2017) ical Physics (2020) hematics (2021) hematics (2022)	015)	
 Modul Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel	e appea lor's de lor's de lor's de lor's de lor's de lor's de lor's de lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economat gree (1 major) Mathemat gree (1 major) Mathemat gree (1 major) Mathemat gree (1 major) Economat gree (1 major) Economat gree (1 major) Economat gree (1 major) Economat gree (1 major) Mathemat	ics (2015) hematics (2015) ical Physics (2015) onal Mathematics (20 ical Physics (2016) hematics (2017) ical Physics (2020) hematics (2021) hematics (2022) ical Data Science (20	015)	
 Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel	e appea lor's de lor's de lor's de lor's de lor's de lor's de lor's de lor's de lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat gree (1 major) Computati gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Mathemat grea (1 major) Mathemat	ics (2015) hematics (2015) ical Physics (2015) onal Mathematics (20 ical Physics (2017) ical Physics (2020) hematics (2021) hematics (2022) ical Data Science (20	015)	
 Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel	e appea lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat gree (1 major) Mathemat gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Mathemat gram Mathematics (2023 gree (1 major) Mathemat	ics (2015) hematics (2015) ical Physics (2015) onal Mathematics (20 ical Physics (2016) hematics (2017) ical Physics (2020) hematics (2021) hematics (2022) ical Data Science (20 i) ics (2023)	015)	
 Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel	e appea lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat gree (1 major) Computati gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Mathemat grea (1 major) Mathemat	ics (2015) hematics (2015) ical Physics (2015) onal Mathematics (20 ical Physics (2016) hematics (2017) ical Physics (2020) hematics (2021) hematics (2022) ical Data Science (20 i) ics (2023) hematics (2023)	015)	
 Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel	e appea lor's de lor's de	ars in gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat gree (1 major) Mathemat gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Economatl gree (1 major) Mathemat gram Mathematics (2023) gree (1 major) Mathemat gree (1 major) Mathemat	ics (2015) hematics (2015) ical Physics (2015) onal Mathematics (20 ical Physics (2016) hematics (2017) ical Physics (2020) hematics (2021) hematics (2022) ical Data Science (20 i) ics (2023) hematics (2023) ical Physics (2024)	015)	

Modul					Abbreviation		
E-Learning and Blended Learning Mathematics 2					10-M-VHB2-152-m01		
Module coordinator				Module offered by			
			aticc)	· ·			
ECTS	n of Studies Mathematik (Mathematics) S Method of grading Only		<u>í í í í í í í í í í í í í í í í í í í </u>	Institute of Mathematics			
2		successfully completed	Only after succ. con	ipt. of module(s)			
		, ,					
Duratio		Module level	Other prerequisites				
1 seme		undergraduate					
Conter							
Becom	ing far	niliar with and reflecting t	echniques in e-learni	ing and blended lear	rning in mathematics.		
Intend	ed lear	ning outcomes					
The stu	udent is	able to employ advance	d methods of e-learn	ing and blended lea	rning in mathematics-		
Course	es (type	, number of weekly conta	ct hours, language –	- if other than Germa	in)		
Ü (2)		,			,		
• •	e type: e	Learning, mostly Virtuell	e Hochschule Bavern	(vhb)			
			· · ·		ition offered — if not every seme-		
		ion on whether module c			alon oncrea in not every serie		
		based, 15 to 20 hours)		,			
	•	ffered: Once a year, sum	mer semester				
	tion of p	· · ·					
/ IIIO CU							
			-				
Additio	onal inf	ormation					
	_						
Worklo	oad						
60 h							
Teachi	ng cycl	e					
Poforr	ad to in	LPOI (examination regu	lations for toaching	dogroo programmoc)			
				legiee programmes)			
	e appea						
		gree (1 major) Mathemati					
		gree (1 major) Economath					
		gree (1 major) Mathemati	• -	``			
		gree (1 major) Computati		015)			
		gree (1 major) Mathemati	-				
		gree (1 major) Economath					
	Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major) Economathematics (2021)						
	Bachelor's degree (1 major) Economathematics (2022) Bachelor's degree (1 major) Mathematical Data Science (2022)						
		gram Mathematics (2023		<i>∠∠</i> J			
		gree (1 major) Mathemati					
		gree (1 major) Mathemati gree (1 major) Economati	-				
	Bachelor's degree (1 major) Mathematical Physics (2024) Bachelor's degree (1 major) Economathematics (2024)						
		gree (1 major) Economati	•				
		<u> </u>	· ······ (-·-)/				

	e title				Abbreviation	
Introduction to Number Theory for Mathematical Physics					10-M-ZTHP-152-m01	
Module coordinator				Module offered by		
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathematics		
ECTS		od of grading	Only after succ. con	npl. of module(s)		
10	numerical grade					
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
tests a	nd met		ructure of the residue	e class rings, theory	ation, modular arithmetics, prime of quadratic remainder, quadratio	
Intend	ed lear	ning outcomes				
		acquainted with the fun methods and proof tech			ber theory. He/she is able to em-	
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	an)	
V (4) +	Ü (2)					
Math						
ster, in a) writt	formati en exa	ion on whether module c mination (approx. 90 to 1	an be chosen to earn 180 minutes, usually	a bonus) chosen) or	ation offered — if not every seme-	
ster, in a) writt b) oral c) oral	formati en exan examir examin age of a	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o ssessment: German and	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes	a bonus) chosen) or s) or	ation offered — if not every seme-	
ster, in a) writt b) oral c) oral Langua	formati en exar examir examin age of a ble for	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o issessment: German and bonus	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes	a bonus) chosen) or s) or	ation offered — if not every seme-	
ster, in a) writt b) oral c) oral Langua credita	formati en exar examir examin age of a ble for	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o issessment: German and bonus	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes	a bonus) chosen) or s) or	ation offered — if not every seme-	
ster, in a) writt b) oral c) oral Langua credita Allocat	formati en exam examin examin age of a ble for ion of j	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o issessment: German and bonus	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes	a bonus) chosen) or s) or	ation offered — if not every seme	
ster, in a) writt b) oral c) oral Langua credita Allocat	formati en exam examin examin age of a ble for ion of j	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o issessment: German and bonus places	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes	a bonus) chosen) or s) or	ation offered — if not every seme-	
ster, in a) writt b) oral c) oral Langua credita Allocat	formati en examir examin age of a ble for ion of p onal inf	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o issessment: German and bonus places	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes	a bonus) chosen) or s) or	ation offered — if not every seme-	
ster, in a) writt b) oral c) oral Langua credita Allocat Additic Worklo	formati en examir examin age of a ble for ion of p onal inf	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o issessment: German and bonus places	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes	a bonus) chosen) or s) or	ation offered — if not every seme-	
ster, in a) writt b) oral c) oral Langua credita Allocat Additic Worklo 300 h	formati en examir examin age of a ble for ion of p onal inf	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o ssessment: German and bonus places	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes	a bonus) chosen) or s) or	ation offered — if not every seme-	
ster, in a) writt b) oral c) oral Langua credita Allocat Additic Worklo	formati en examir examin age of a ble for ion of p onal inf	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o ssessment: German and bonus places	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes	a bonus) chosen) or s) or	ation offered — if not every seme-	
ster, in a) writt b) oral c) oral Langua credita Allocat Additic 300 h Teachin 	formati en examir examin age of a ble for ion of p onal inf pad	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o ssessment: German and bonus places formation	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes /or English	a bonus) chosen) or s) or per candidate)		
ster, in a) writt b) oral c) oral Langua credita Allocat Additic 300 h Teachin 	formati en examir examin age of a ble for ion of p onal inf pad	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o ssessment: German and bonus places	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes /or English	a bonus) chosen) or s) or per candidate)		
ster, in a) writt b) oral c) oral Langua credita Allocat Additic 300 h Teachin 	formati en examir examin age of a ble for ion of p onal inf pad	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o issessment: German and bonus places formation	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes /or English	a bonus) chosen) or s) or per candidate)		
ster, in a) writt b) oral c) oral Langua credita Allocat Morklo 300 h Teachin Referre Modulo	formati en examir examir examin ge of a ble for ion of p onal inf pad ng cycl ed to in	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o issessment: German and bonus places formation	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes /or English	a bonus) chosen) or s) or per candidate)		
ster, in a) writt b) oral c) oral Langua credita Allocat Additic Worklo 300 h Teachii Referre Bachel	formati en examin examin age of a ble for ion of p onal inf onal inf onal inf ead ed to in e appea or's de	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups of issessment: German and bonus places formation e LPO I (examination regu	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes /or English ulations for teaching-o	a bonus) chosen) or s) or per candidate)		
ster, in a) writt b) oral c) oral Langua credita Allocat Morklo 300 h Teachin Referre Bachel Bachel Bachel Bachel	formati en examin examin examin ige of a ble for ion of p ional inf onal inf ead ed to in e appea or's de or's de or's de	ion on whether module c mination (approx. 90 to a nation of one candidate e nation in groups (groups o issessment: German and bonus places formation e LPO I (examination regu ars in gree (1 major) Mathemat	an be chosen to earn 180 minutes, usually each (15 to 30 minutes of 2, 10 to 15 minutes /or English ulations for teaching-out ical Physics (2015) ical Physics (2016) ical Physics (2020)	a bonus) chosen) or s) or per candidate)		

Module title					Abbreviation			
Astrop	Astrophysics 11-AP-152-mo1							
Module coordinator			Module offered by	ed by				
Managing Director of the Institute of Theoretical Phys and Astrophysics				Faculty of Physics and Astronomy				
ECTS	Metho	od of grading	Only after succ. cor	npl. of module(s)				
6	nume	rical grade						
Duratio		Module level	Other prerequisites	her prerequisites				
1 seme	ster	undergraduate						
Conten								
telesco um, mo	pes an olecula	onomy, coordinates an d detectors, stellar stru r clouds, structure of th arge-scale structures, c	cture and atmosphere e milky way, the local	s, stellar evolution a	nd end stages, inter	stellar medi-		
Intende	ed lear	ning outcomes						
physica	al obse	are familiar with the mo rvations and evaluatior familiar with the physic	ns. They are able to use	e these methods to p	lan and analyse owr	n observati-		
Course	s (type	, number of weekly con	tact hours, language –	- if other than Germa	n)			
V (2) + Module		t in: German or English						
Method	d of ass	sessment (type, scope, ion on whether module			tion offered — if not	every seme-		
		mination (approx. 90 to						
		nation of one candidate		utes) or				
		ation in groups (groups		ites per candidate) o	r			
		ort (approx. 8 to 10 pag n/talk (approx. 30 min						
		amination was chosen a		ent, this may be cha	nged and assessme	nt may in-		
stead t	ake the	e form of an oral examir	ation of one candidate	e each or an oral exa	mination in groups.	If the method		
		t is changed, the lectur the latest.	er must inform studen	ts about this by four	weeks prior to the o	riginal exami-		
		ssessment: German an	d/or English					
Allocat								
Additio	nal inf	ormation						
Worklo	ad							
180 h								
Teaching cycle								
Referred to in LPO I (examination regulations for teaching-degree programmes)								
§ 22 ll Nr. 1 h)								
§ 22 Nr. 2 f)								
§ 22 Nr. 3 f)								
Module appears in								
Bachelor's degree (1 major) Physics (2015)								
	with 1 ma	jor Mathematical Physics	-	e generated 18-Apr-2025 • exa	-	page 72 / 118		
(2015)			ta record Bachelo	or (180 ECTS) Mathematische	PTIYSIK - 2015			

UNIVERSITÄT WÜRZBURG

Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) First state examination for the teaching degree Grundschule Physics (2015) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2015) First state examination for the teaching degree Realschule Physics (2015) First state examination for the teaching degree Gymnasium Physics (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2015) First state examination for the teaching degree Mittelschule Physics (2015) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2015) Bachelor's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2018) First state examination for the teaching degree Realschule Physics (2018) First state examination for the teaching degree Gymnasium Physics (2018) First state examination for the teaching degree Mittelschule Physics (2018) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2018) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2018) Master's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2020) First state examination for the teaching degree Grundschule Physics (2020) First state examination for the teaching degree Gymnasium Physics (2020) First state examination for the teaching degree Realschule Physics (2020) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Physics (2020) Master's degree (1 major) Quantum Technology (2021) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

Curren	e title				Abbreviation
Current Topics in Mathematical Physics					11-BXMP5-152-m01
Module	e coord	inator		Module offered by	
		f examination commit	tee Mathematische	Faculty of Physics	
•	Physik (Mathematical Physics)				
ECTS	ECTS Method of grading Only after succ. compl. of module(s)				
5 numerical grade					
Duratio	on	Module level	Other prerequisites		
1 seme	ester	undergraduate	Approval from exan	nination committee	required.
Contents					
Current or stud			sics. Accredited academ	nic achievements, e.	g. in case of change of university
Intend	ed lear	ning outcomes			
unders subjec	tand th	e numeric and analyt fic contexts and know	ic methods necessary to the application areas.	acquire this knowle	line of Mathematical Physics and edge. They are able to classify the
		, number of weekly co	ontact hours, language –	– if other than Germ	an)
V (2) +					
			e, language — if other th le can be chosen to earr		ation offered — if not every seme-
written examination (approx. 90 to 120 minutes) or oral examination of one candidate each (approx. 30 minutes) or oral examination in groups (groups of 2, approx. 30 minutes per candidate) or project report (approx. 8 to 10 pages) or presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.					
If a writ stead t of asse nation	tten exa take the essmen date at	sentation/talk (approx amination was choser e form of an oral exam t is changed, the lectu the latest.	k. 30 minutes). n as method of assessm ination of one candidat urer must inform studen	ent, this may be cha e each or an oral exa	anged and assessment may in- amination in groups. If the metho
If a writ stead t of asse nation Langua	tten exa take the essmen date at	sentation/talk (approx amination was choser e form of an oral exam t is changed, the lectu the latest. ssessment: German a	k. 30 minutes). n as method of assessm ination of one candidat urer must inform studen	ent, this may be cha e each or an oral exa	anged and assessment may in- amination in groups. If the metho
If a writ stead t of asse nation Langua	tten exa take the essmen date at age of a	sentation/talk (approx amination was choser e form of an oral exam t is changed, the lectu the latest. ssessment: German a	k. 30 minutes). n as method of assessm ination of one candidat urer must inform studen	ent, this may be cha e each or an oral exa	anged and assessment may in- amination in groups. If the metho
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Curren	e title				Abbreviation
Current Topics in Mathematical Physics					11-BXMP6-152-m01
Modul	e coord	linator		Module offered by	
		f examination commit	tee Mathematische	Faculty of Physics	and Astronomy
•	Physik (Mathematical Physics)				
ECTS Method of grading Only after succ. compl. of module(s)					
6 numerical grade					
Duratio	on	Module level	Other prerequisites	5	
1 seme	ester	undergraduate	Approval from exan	nination committee i	required.
Contents					
	t topics ly abroa		sics. Accredited academ	nic achievements, e.	g. in case of change of university
Intend	ed lear	ning outcomes			
unders subjec	stand th t-speci	ne numeric and analyt fic contexts and know	ic methods necessary to the application areas.	acquire this knowle	line of Mathematical Physics and edge. They are able to classify the
		, number of weekly co	ontact hours, language -	– if other than Germa	an)
V (3) +	-				
			e, language — if other th le can be chosen to earr		ation offered — if not every seme-
written examination (approx. 90 to 120 minutes) or oral examination of one candidate each (approx. 30 minutes) or oral examination in groups (groups of 2, approx. 30 minutes per candidate) or project report (approx. 8 to 10 pages) or presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.					
		t the latest. Issessment: German a	and/or English	ts about this by four	
Langua		ssessment: German a	nd/or English	ts about this by four	
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Langua Allocat Additio 180 h Teachi 	age of a tion of onal inf oad	e			weeks prior to the original examination of the origination
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Langua Allocat Additic Worklo 180 h Teachi Referre Modulo	age of a tion of onal inf oad ng cycl ed to in e appea	e LPOI (examination r ars in	egulations for teaching-		weeks prior to the original exam
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Langua Allocat Additic Worklo 180 h Teachi Referre Bachel Bachel Bachel	age of a tion of onal inf oad ed to in e appea lor's de lor's de	e LPO I (examination r ars in gree (1 major) Mathen gree (1 major) Mathen	egulations for teaching-		weeks prior to the original exam

Curren	e title			_	Abbreviation
Current Topics in Mathematical Physics					11-BXMP8-152-m01
Module	e coord	inator		Module offered by	,
		f examination commit	tee Mathematische	Faculty of Physics	
•	Physik (Mathematical Physics)				
ECTS	ECTS Method of grading Only after succ. compl. of module(s)				
8 numerical grade					
Duratio	on	Module level	Other prerequisites	5	
1 seme	ester	undergraduate	Approval from exan	nination committee	required.
Contents					
Current or stud			sics. Accredited academ	nic achievements, e.	g. in case of change of university
Intend	ed lear	ning outcomes			
unders subjec	tand th	e numeric and analyti fic contexts and know	c methods necessary to the application areas.	o acquire this knowle	line of Mathematical Physics and edge. They are able to classify the
		, number of weekly co	ntact hours, language -	– If other than Germ	anj
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			, language — if other th e can be chosen to earr		ation offered — if not every seme-
written examination (approx. 90 to 120 minutes) or oral examination of one candidate each (approx. 30 minutes) or oral examination in groups (groups of 2, approx. 30 minutes per candidate) or project report (approx. 8 to 10 pages) or presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.					
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If a writ stead t of asse nation Langua Allocat Worklo 240 h Teachin 	tten exa take the essmen date at age of a tion of p onal inf oad	sentation/talk (approx amination was chosen e form of an oral exami t is changed, the lectu the latest. ssessment: German a places ormation	. 30 minutes). as method of assessm ination of one candidat irer must inform studen	ent, this may be cha e each or an oral exa ts about this by four	anged and assessment may in- amination in groups. If the metho r weeks prior to the original examination in groups and the original examination in groups. If the metho
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Module title				Abbreviation		
Compu	Itationa	al Physics		11-CP-152-m01		
Module	e coord	linator		Module offered by		
Manag and As	-	ector of the Institute of sics	Theoretical Physics	Faculty of Physics and Astronomy		
ECTS				npl. of module(s)		
6	nume	rical grade				
Duratio	Duration Module level Other prerequis			6		
1 semester undergraduate						
Conten	nts					
• r • s • g	 Introduction to programming on the basis of C++ / Java /Mathematica numerical solution of differential equations simulation of chaotic systems generation of random numbers random walk many-particle processes and reaction-diffusion model 					
Intend	ed lear	ning outcomes				
They ha	ave kno	have knowledge of two owledge of numerical st tysical problems, e.g. a	andard methods and	are able to apply com	puter-assisted proc	
Course	es (type	, number of weekly con	tact hours, language -	– if other than Germa	n)	
V (3) + Module		t in: German or English				
		sessment (type, scope,			tion offered — if not	every seme-
ster, in	format	ion on whether module	can be chosen to earr	ı a bonus)		
b) oral c) oral d) proju- lf a writ stead t of asse nation Langua	examin examin ect rep tten ex take the essmen date at age of a	mination (approx. 90 to nation of one candidate nation in groups (groups ort (approx. 8 to 10 pag amination was chosen e form of an oral examin t is changed, the lectur t the latest. Issessment: German an offered: Once a year, with	e each (approx. 30 min s of 2, approx. 30 minu es) or presentation/ta as method of assessm nation of one candidat er must inform studen d/or English	ites per candidate) o lk (approx. 30 minute ent, this may be cha e each or an oral exa	es). nged and assessme mination in groups.	If the method
Allocat	tion of	places				
Additio	onal inf	ormation				
Worklo	oad					
180 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination reg	gulations for teaching-	degree programmes)		
		· · · · · · · · · · · · · · · · · · ·				
Module	e appe	ars in				
Bachel	lor's de	gree (1 major) Physics (gree (1 major) Mathema	-			
		jor Mathematical Physics	JMU Würzburg	• generated 18-Apr-2025 • exa or (180 ECTS) Mathematische	-	page 77 / 118

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

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

V (4) + Ü (2)

Module taught in: Ü: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 120 minutes)

Language of assessment: German and/or English

Allocation of places

--

Additional information

Workload

240 h

Teaching cycle

--

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

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)

Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015)

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

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

Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)

Bachelor's degree (1 major) Mathematics (2023)

exchange program Physics (2023)

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

Module title Abbreviation					Abbreviation		
Classic	cal Phys	sics 2 (Heat and Electro	omagnetism)		11-E-E-152-m01		
Module	e coord	inator		Modulo offered by			
			Analiad Direct	Module offered by			
-		ector of the Institute of		Faculty of Physics a	and Astronomy		
		Only after succ. con	ipl. of module(s)				
8							
Duratio		Module level	Other prerequisites				
1 semester		undergraduate		Admission prerequisite to assessment: completion of exercises (approx 13 exercise sheets per semester). Students who successfully completed			
			-		,	•	
					admission to assess		
				students about the r	espective details at I	ine beginning	
-			of the semester.				
Conten							
); temperature and qua		ometer, Kelvin scale;		
			ffusion, convection, rac		domon		
			dynamics, entropy, irrev efficiency, example: Sti		aemon;		
•	•		natter (also solids), van	5 5	oint, phase transitio	ons, critical	
phenoi	mena (o	opalescence), coexiste	nce region, Joule-Thom	son;	·		
		cs, basic concepts: Ele	ctrical charge, forces; e	electric field, reps. fie	eld concept, field lin	es, field of a	
point c	•		la mala la la consta da Constata na				
-		es; divergence and GS	lomb's law, definition	of "river"; Gaussian s	surface, divergence t	neorem; spe	
			E-box, electric. potent	ial, potential differer	nce, voltage: notenti	al equation.	
			rtant examples: Sphere				
		egner wheel;		· · · ·			
			omogeneous field, Mill				
			omogeneous and inhor				
		-	on, capacity; plate and sation, displacement a				
			acitor; Piezoelectric eff		sation, microscopic	iiiiage, uiei-	
	•		ensity, drift velocity, co		ns;		
			stivity, temperature de			stive and non-	
	NTC, P						
-			nhoff's rules (meshes, i	nodes); internal resis	stance of a voltage s	ource, mea-	
-		ents; Wheatstone brid	ige; Capacitor charge; galva	nic element: thermo	voltage		
			n in solids: Band mode		-	es:	
-			/s; permanent magnet,		. –		
-			to e-box, magn. river,				
-	•		n, analogous to electric	: scalar potential; ca	lculation of fields, ex	xamples,	
	oltz coi		otic field annual balan	and Lorentz fame	the band wild also and	c motor -!	
			etic field, current balar pectrometer, Wien filter				
•			cts of the field on matte				
			he electron, behaviour		,,,, p		
20. ind	luction,	Faraday's law of induc	tion, Lenz's rule, flux c	hange, eddy electric	field, Waltenhofen's	s pendulum;	
			ons: Transformer, gener				
		-	choice of integration a	rea, displacement cu	irrent; Maxwell's ext	ension, wave	
		well equations;	orations, amplitude, pe	riod and phase now	ver and RMS value o	hmic roci-	
			or, capacitor and coil, p				
	•	tance; performance of			and acpendence,	peaunce.	
-							
Bachelor's (2015)	with 1 ma	jor Mathematical Physics	-	generated 18-Apr-2025 • exa r (180 ECTS) Mathematische	-	page 81 / 118	
(_01)							

23. Resonant circuits, combinations of RLC; series and parallel resonant circuit; forced vibration, damped harmonic oscillator (related to 11-E-M);

24: Hertz dipole, characteristics of irradiation, near field, far field; Rayleigh scattering; accelerated charge, synchrotron radiation, X-rays; 25. Electromagnetic waves: Principles, Maxwell's determination to electromagnetism, radiation pressure (Poynting vector, radiation pressure).

Intended learning outcomes

The students understand the basic principles and contexts of thermodynamics, science of electricity and magnetism. They know relevant experiments to observe and measure these principles and contexts. They are able to apply mathematical methods to the formulation of physical contexts and autonomously apply their knowledge to the solution of mathematical-physical tasks.

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

V (4) + Ü (2)

Module taught in: Ü: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 120 minutes)

Language of assessment: German and/or English

Allocation of places

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Additional information

Registration: If a student registers for the exercises and obtains the qualification for admission to assessment, this will be considered a declaration of will to seek admission to assessment pursuant to Section 20 Subsection 3 Sentence 4 ASPO (general academic and examination regulations). If the module coordinators subsequently find that the student has obtained the qualification for admission to assessment, they will put the student's registration for assessment into effect. Only those students that meet the respective prerequisites can successfully register for an assessment. Students who did not register for an assessment or whose registration for an assessment to whose not put into effect will not be admitted to the respective assessment. If a student takes an assessment to which he/she has not been admitted, the grade achieved in this assessment will not be considered.

Workload

240 h

Teaching cycle

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

§ 53 l Nr. 1 a)

§ 77 | Nr. 1 a)

Module appears in

Bachelor's degree (1 major) Physics (2015)

Bachelor's degree (1 major) Nanostructure Technology (2015)

Bachelor's degree (1 major) Mathematical Physics (2015)

Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015)

First state examination for the teaching degree Grundschule Physics (2015)

First state examination for the teaching degree Realschule Physics (2015)

First state examination for the teaching degree Gymnasium Physics (2015)

First state examination for the teaching degree Mittelschule Physics (2015)

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

First state examination for the teaching degree Grundschule Physics (2018)

First state examination for the teaching degree Realschule Physics (2018)

First state examination for the teaching degree Gymnasium Physics (2018)

First state examination for the teaching degree Mittelschule Physics (2018)

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

Bachelor's with 1 major Mathematical Physics	JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-	page 82 / 118
(2015)	ta record Bachelor (180 ECTS) Mathematische Physik - 2015	

Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) First state examination for the teaching degree Grundschule Physics (2020) First state examination for the teaching degree Gymnasium Physics (2020) First state examination for the teaching degree Realschule Physics (2020) First state examination for the teaching degree Mittelschule Physics (2020) First state examination for the teaching degree Mittelschule Physics (2020) Bachelor's degree (1 major) Functional Materials (2021) Bachelor's degree (1 major) Quantum Technology (2021) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024) Bachelor's degree (1 major) Functional Materials (2025)

Module title					Abbreviation	
Introduction to Solid State Physics					11-E-F-152-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	and Astronomy	
ECTS Method of grading		Only after succ. con	npl. of module(s)			
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	Its					
Somme deman 2. Crys tice de tronic p 3. The theory: 4. Strue electro 5. lattic branch examp 6. Ther therma 7. Elect strong on	 The free-electron gas (FEG), free electrons; density of states; Pauli principle; Fermi-Dirac statistics; spec. heat, Sommerfeld coefficient; electrons in fields: Drude-Lorentz-Sommerfeld; electrical and thermal conductivity, Wie- demann-Franz law; Hall effect; limitations of the model Crystal structure, periodic lattice; types of lattices; Bravais lattice; Miller indices; simple crystal structures; lat- tice defects; polycrystals; amorphous solids; group theoretical approaches, the importance of symmetry for elec- tronic properties The reciprocal lattice (RG), motivation: Diffraction; Bragg condition; definition; Brillouin zones; diffraction theory: Scattering; Ewald construction; Bragg equation; Laue's equation; structure and form factor Structure determination, probes: X-ray, electron, neutron; methods: Laue, Debye-Scherrer, rotating crystal; electron diffraction, LEED lattice vibrations (phonons), equations of motion; dispersion; group velocity; diatomic base: optical, acoustic branch; quantisation: Phonon momentum; optical properties in the infrared; dielectric function (Lorentz model); examples of dispersion curves (occ. Kramers-Kronig), measurement methods Thermal properties of insulators, Einstein and Debye model; phonon density of states; anharmonicity and thermal expansion; thermal conductivity; Umklapp processes; crystal defects Electrons in a periodic potential, Bloch theorem; band structure; approximation of nearly free electrons (NFE); strongly bound electrons (tight binding, LCAO); examples of band structures, Fermi surfaces, spin-orbit interacti- 					
Intend	ed lear	ning outcomes				
dynam ture of Solid-S	ics, the solids State Ph	ermal properties, principle and know the experiment	es of electronic prope tal methods and theo oply mathematical m	erties (free electron g pretical models for th ethods to the formul	es (bonding and structure, lattice gas)). They understand the struc- ne description of phenomena of ation of physical contexts and asks.	
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	in)	
V (4) + Module	· · ·	t in: Ü: German or Englisł	1			
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-	
		nation (approx. 120 minu ssessment: German and,				
Allocat	ion of	places				
Additio	onal inf	ormation				
Worklo	ad					
240 h						
240 11						

Teaching cycle

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

Module appears in

Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Mathematics (2023) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

Module title					Abbreviation		
Classic	al Phys	sics 1 (Mechanics)			11-E-M-152-m01		
		-					
Module	e coord	inator		Module offered by			
Manag	ing Dire	ector of the Institute of	of Applied Physics	Faculty of Physics	and Astronomy		
ECTS Method of grading		Only after succ. o	compl. of module(s)				
8	nume	rical grade					
Duration Module level Othe		Other prerequisit	tes				
1 seme		undergraduate		Admission prerequisite to assessment: completion of exercises (ap			
2 0 0 0				•	ents who successfully completed		
			-	•	r admission to assessment. The		
					respective details at the beginning		
				in students about the	respective details at the beginning		
			of the semester.				
Conten	ts						
1. Princ	iples: I	Physical quantities, p	refactors, derived qua	ntities, dimensional a	nalysis, time / length / mass (de-		
			SI), importance of me		,		
2. Poin	t Mech	anics: Kinematics, m	otion in 2D and 3D / v	ectors, special cases:	Uniform and constant accelerated		
			r motion in polar coor				
					the pendulum, forces on an ato-		
				of the equations of mo	otion and solutions;		
		nergy: (Kinetic) perfo					
-		-		d momentum conserv	ation, surges in centre of mass		
		ystem, rocket equation					
				tial, potential energy;	law, weight scale, field strength		
		of gravity (general re					
					energy, moment of inertia, analo-		
-		potential;	JIIS, Salelliles (geosla	lionary and interstella	r), escape velocities, trajectories		
			erence systems annar	ent forces. Foucault ne	endulum, Coriolis force, centrifu-		
gal for		. mertiat system, rere	incluce systems, appar				
		nsformation: Brief di	gression to Maxwell's	equations, ether, Mich	helson interferometer, Einstein's		
					length contraction, relativistic im-		
pulse;	, , ,		,,	,	,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,		
	id body	and gyroscope: Dete	ermining the centre of	mass, inertia tensor a	nd -ellipsoid, principal axes and		
					e; gyroscope: Precession and nu-		
tation,	the Ear	th as a spinning top;					
		atic and dynamic fric	tion, stick-slip motion	, rolling friction, visco	us friction, laminar flow, eddy for-		
mation							
					tion (DGL) on forces, torque and		
					ulum, physical pendulum, damped		
				ed vibration, Fourier a			
-	•	_	s and eigenfunctions,	double pendulum, de	terministic vs. chaotic motion,		
		namics and chaos;	voo opdianaterationi	nun nelesterter	inciple of our emportion will a st		
					inciple of superposition, reflection		
relation	•	iu cioseu enu, speed	or sound; interierence	e, Doppler effect; phas	se and group velocity, dispersion		
		ormation of solid box	lies. Flastic modulus	general Hooke's law, e	elastic waves.		
					gle, capillary forces, steady flows,		
					essure, compressibility and com-		
pressiv			, all land, buildinethe				
•			nd real gas. averages.	distribution functions.	, equipartition theorem, Brownian		
					s of freedom, specific heat		
	,	,,,,					

Intended learning outcomes

The students understand the basic contexts and principles of mechanics, vibration, waves and kinetic theory of gases. They are able to apply mathematical methods to the formulation of physical contexts and autonomously apply their knowledge to the solution of mathematical-physical tasks.

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

V (4) + Ü (2)

Module taught in: Ü: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 120 minutes)

Language of assessment: German and/or English

Allocation of places

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Additional information

Registration: If a student registers for the exercises and obtains the qualification for admission to assessment, this will be considered a declaration of will to seek admission to assessment pursuant to Section 20 Subsection 3 Sentence 4 ASPO (general academic and examination regulations). If the module coordinators subsequently find that the student has obtained the qualification for admission to assessment, they will put the student's registration for assessment into effect. Only those students that meet the respective prerequisites can successfully register for an assessment. Students who did not register for an assessment or whose registration for an assessment was not put into effect will not be admitted to the respective assessment. If a student takes an assessment to which he/she has not been admitted, the grade achieved in this assessment will not be considered.

Workload

240 h

Teaching cycle

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

§ 53 | Nr. 1 a)

§ 77 | Nr. 1 a)

Module appears in

module appears in					
Bachelor's degree (1 major) Physics (2015)					
Bachelor's degree (1 major) Nanostructure Technology (2015)					
Bachelor's degree (1 major) Mathematical Physics (2015)					
(Minor, 2015)					
ee Grundschule Physics (2015)					
ee Realschule Physics (2015)					
ee Gymnasium Physics (2015)					
ee Mittelschule Physics (2015)					
iysics (2016)					
ee Grundschule Physics (2018)					
ee Realschule Physics (2018)					
ee Gymnasium Physics (2018)					
ee Mittelschule Physics (2018)					
echnology (2020)					
iysics (2020)					
(Minor, 2020)					
First state examination for the teaching degree Grundschule Physics (2020)					
First state examination for the teaching degree Gymnasium Physics (2020)					
ee Realschule Physics (2020)					
JMU Würzburg • generated 18-Apr-2025 • exam. reg. da- ta record Bachelor (180 ECTS) Mathematische Physik - 2015	page 87 / 118				
	ysics (2015) (Minor, 2015) ee Grundschule Physics (2015) ee Gealschule Physics (2015) ee Gymnasium Physics (2015) ee Mittelschule Physics (2015) sysics (2016) ee Grundschule Physics (2018) ee Gealschule Physics (2018) ee Mittelschule Physics (2018) ee Mittelschule Physics (2018) ee chnology (2020) sysics (2020) (Minor, 2020) ee Grundschule Physics (2020) ee Grundschule Physics (2020) ee Grundschule Physics (2020) ee Realschule Physics (2020) ee Realschule Physics (2020)				

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

First state examination for the teaching degree Mittelschule Physics (2020) Bachelor's degree (1 major) Functional Materials (2021) Bachelor's degree (1 major) Quantum Technology (2021) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024) Bachelor's degree (1 major) Functional Materials (2025)

Bachelor's with 1 major Mathematical Physics

(2015)

Module title				Abbreviation	
Optics	and Waves			11-E-O-152-m01	
Module	e coordinator		Module offered by		
Managi	ing Director of the Institute of Ap	oplied Physics	ied Physics Faculty of Physics and Astronomy		
		Only after succ. com	pl. of module(s)		
8 numerical grade					
Duratio		Other prerequisites			
1 seme	ster undergraduate				
Conten	ts				
2. Light constant tion, bi 3. Geor tion, op thick le astigma 4. Optio am vs. 5. Wave profile) Mach-Z 6. Diffra ar-field 8. Failu ves (Da 10. Wav quist-S in quar dinger' 11. Mat son to lue equ gy quar (states,	nt; absorption, Kramers-Kronig r refringence, optical activity (dip netrical optics: basic concepts, otical tunneling, evanescent way enses, lens systems, lens grinde atism, coma, distortion, correcti- cal instruments: characteristics; image construction (electron ler e optics: spatial and temporal co , thin films, parallel layers, wed cender, Fabry-Perot). action in the far field: Fraunhofe Rayleigh & Abbé criterion, Fouri action in the near field: Fresnel, microscopy, holography, Huyge re of classical physics I - from li otoelectric effect and Einstein's m structure of nature re of classical physics II - partic visson-Germer-experiment, dou ve mechanics: wave packets, ph hannon theorem, wave function atum mechanics (double-slit exp s cat). hematical concepts of quantum wave optics, free particle and pa	in the medium; disp relation, interfaces, Fr ole) Fermat's principle, op ves, prism; normal an r formula, aberration on approaches). camera, eye, magnif nses, electron micros oherence, Young's do ge-shaped layers, ph r diffraction, , single fer optics, optical grad omic lattices, convolu- near-field diffraction ens-Fresnel concept; ght wave to photon: I explanation, Compto les as waves: de Brog able slit interference). nase and group veloci- as probability ampli periment & which-way mechanics: Schrödin articles in a potential, potential step, potent	ersion, complex and resnel equations, po ptical path, planar in ad anomalous disper s, imaging errors (sp ying glass, microsco cope), confocal micro puble slit experiment ase shift, Newton rin slit, intensity distribu- ting, n-fold slit, inter- ution theorem. at circular apertures white light hologram black body radiation on effect, light as a pa- glie's matter wave co ity (recap of 11-EM), of tude, probability of r y information, collap nger equation as way time-independent S ial barrier and tunne	frequency-dependent dielectric larization, generation by absorp- iterfaces, Snell's law, total reflec- sion, curved interfaces, thin and herical & chromatic aberration, ope, telescope types, bundle be- oscopy. c, interference pattern (intensity ngs, interferometer (Michelson, ution, apertures, resolving nsity distribution, grating spectro- disks, Fresnel zone plate, ne- disks, fresnel zone plate, ne-	
			- f		
stand t measu	The students understand the basic principles and contexts of radiation, wave and quantum optics. They under- stand the theoretical concepts and know the structure and application of important optical instruments and measuring methods. They are able to apply mathematical methods to the formulation of physical contexts and autonomously apply their knowledge to the solution of mathematical-physical tasks.				
Course	s (type, number of weekly conta	ct hours, language —	- if other than Germa	n)	
V (4) + Module	Ü (2) 2 taught in: Ü: German or English	1			
				tion offered — if not every seme-	
	formation on whether module ca examination (approx. 120 minu		a bonus)		

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Language of assessment: German and/or English

Allocation of places

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Additional information

Workload

240 h

Teaching cycle

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

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) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) Bachelor's degree (1 major) Mathematics (2023) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

Module title					Abbreviation	
Nuclear and Elementary Particle Physics				11-E-T-152-m01		
Module	e coord	inator		Module offered by		
Managing Director of the Institute of Applied		plied Physics	Faculty of Physics a	nd Astronomy		
ECTS	ECTS Method of grading Only after succ. compl. of module(s)			npl. of module(s)		
6 numerical grade						
Duratio	on	Module level	Other prerequisites	i		
1 seme	ster	undergraduate				
Conten	ts					
2. Meth charge 3. Nucl 4. Strue spin-or 5. Radii 6. Nucl the che 7. Radii duction 8. Instr 9. Elect 10. Strue confine 11. Wea ce, exc	 Overview, historical introduction, history and significance of Nuclear and Particle Physics Methods of Nuclear Physics, scattering and spectroscopy, nuclear radius, composition of matter, mass and charge distribution in the nucleus, the discovery of the proton and neutron Nuclear models, the mass of the atomic nuclei, droplet model, bonding energy, nuclear shell model Structure of cores, angular momentum, spin, parity, mag. and electr. moments, collective excitation forms, spin-orbit interaction Radioactivity and spectroscopy, radioactive decay, natural and civilisational sources of ionising radiation Nuclear energy, nuclear fission, nuclear reactors, nuclear fusion, star power, star development, formation of the chemical elements of hydrogen Radiation and matter, interaction of radiation and matter, Bethe-Bloch formula, photoelectric effect, pair production Instruments, accelerators and detectors Electromagnetic interaction, differential cross section, virtual photons, Feynman graphs, exchange interaction of Strong interaction, quarks, gluons, colour and degree of freedom, deep-inelastic electron-proton scattering, confinement, asymptotic freedom, particle zoo, isospin, strangeness, SU (3) symmetry, antiprotons Weak interaction, cracked mirror symmetries, Wu experiment, charge conjugation, time reversal, CP invariance, exchange particles, W and Z, neutrinos, neutrino vibrations Standard model, three families of leptons and quarks, quark-lepton symmetry, Higgs boson, free parameters 					
	ave an				and Elementary Particle Physics. the theoretical models which de-	
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
V (3) + Module	• • •	t in: Ü: German or English	1			
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-	
		nation (approx. 120 minu ssessment: German and,				
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
180 h						
Teachi	ng cycl	ρ				
	Scyce					
Doforro	d to in	LPO I (examination regu	lations for toaching	dograa programmee)		
Reieffe			iations for teaching-	aegree programmes)		

Module appears in

Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (2020) Bachelor's degree (1 major, 2020) Bachelor's degree (1 major) Mathematics (2023) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

Module title Abbreviation						
Group 1	Theory			-	11-GRT-152-m01	
Module	coord	inator		Module offered by		
		ector of the Institute of T	boorotical Physics	Faculty of Physics a	nd Astronomy	
and Ast	trophys	sics	·		nu Astronomy	
ECTS		od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Group t	heory.	Finite groups. Lie group	s. Lie algebra. Depicti	on. Tensors. Classifi	cation theorem. Appli	ications.
Intende	ed lear	ning outcomes				
group t	heory a	know the basics of grou and to solve them by us cessing of physical pro	ing the acquired meth			
Courses	s (type	, number of weekly cont	act hours, language –	- if other than Germa	n)	
V (2) + I Module		t in: German or English				
		sessment (type, scope,	anguage — if other th	an German, examina	tion offered — if not e	everv seme-
		ion on whether module				
c) oral e d) proje e) prese If a writ stead ta of asse nation Langua	examin ect repo entatio ten exa ake the ssmen date at ge of a	nation of one candidate ation in groups (groups ort (approx. 8 to 10 page n/talk (approx. 30 minu amination was chosen a form of an oral examin t is changed, the lecture the latest. ssessment: German an	of 2, approx. 30 minu es) or ites). is method of assessme ation of one candidate er must inform student	tes per candidate) o ent, this may be chan e each or an oral exa	nged and assessment mination in groups. If	f the method
Allocat	ion of j	olaces				
			_			
Additio	nal inf	ormation				
Worklo	ad					
180 h						
Teachir	ıg cvcl	e				
	0 7					
Referre	d to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
Module	e appea	ars in				
Bachelo	or's de	gree (1 major) Physics (2	2015)			
		gree (1 major) Mathema	-			
Bachelo	or's de	gree (1 major) Mathema	tical Physics (2016)			
		gree (1 major) Physics (2	•			
		gree (1 major) Mathema				
		gram Physics (2023)				
		gree (1 major) Mathema	tical Physics (2024)			
Bachelor's		jor Mathematical Physics	JMU Würzburg •	generated 18-Apr-2025 • exa	-	page 93 / 118
(2015)			ta record Bachelo	r (180 ECTS) Mathematische	Physik - 2015	

Module	e title				Abbreviation	
Mather	natical	Methods of Physics		·	11-M-MR-152-m01	
Module coordinator Module of						
				Module offered by		
Managi and Asi	-	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	Ind Astronomy	
ECTS		od of grading	Only after succ. con	npl. of module(s)		
6	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
2 seme	ster	undergraduate				
Conten	ts					
		nathematics and basic ca d preparation of the mod				
Intende	ed lear	ning outcomes				
The stu	dents	have knowledge of the prevention of the preventi		tics and elementary	calculation methods	which are
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	in)	
		V (2) + Ü (1)				
		t in: German or English				
		sessment (type, scope, la ion on whether module c			tion offered — if not	every seme-
		successful completion of x. 15 minutes)	approx. 50% of appr	ox. 13 exercise sheet	ts) or	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo			-			
180 h	au					
			-			
Teachi	ng cycl	e				
Referre	d to in	LPOI (examination regu	llations for teaching-	degree programmes)		
§ 53 N						
<u>§ 77 N</u>		•				
Module						
		gree (1 major) Physics (2	-	-)		
		gree (1 major) Nanostruc gree (1 major) Mathemat		5)		
		gree (1 major) Mathemat	• •			
		gree (1 major, 1 minor) Pl	-	Dhysics (2015)		
		mination for the teaching mination for the teaching		• •		
		mination for the teaching		•		
		mination for the teaching		•		
		gree (1 major) Mathemat		, -)/		
		mination for the teaching	•	e Physics (2018)		
		mination for the teaching		•		
		mination for the teaching		•		
First sta	ate exa	mination for the teaching	g degree Mittelschule	Physics (2018)		
Bachelor's	with 1 ma	jor Mathematical Physics	JMU Würzburg •	generated 18-Apr-2025 • exa	am. reg. da-	page 94 / 118
2015)				r (180 ECTS) Mathematische		

Module Managir ECTS	d Error An	alysis				
Managir ECTS	coordinat				11-P-FR1-152-m01	
Managir ECTS	LUUIUIIIdl	or		Module offered by		
ECTS 2		r of the Institute of A	Applied Physics	Faculty of Physics a	and Astronomy	
2	Method of		Only after succ. con		Ind Astronomy	
		essfully completed				
Duratior	n Mo	dule level	Other prerequisites			
1 semes	ter und	lergraduate	Admission prerequi	site to assessment:	•	
				per semester). Stude rcises will qualify for		
				students about the re		
			of the semester.			
Content	s		,			
	f errors, er ndard devi	••	nd propagation, graph	nic representations,	linear regression, m	ean values
Intende	d learning	outcomes				
			asuring results on the scuss the conclusions		gation and of the pri	nciples of
Courses	(type, nu	mber of weekly cont	act hours, language –	- if other than Germa	ın)	
V (1) + Ü Module	• •	Ü: German or Englis	sh			
			anguage — if other th	an German, examina	tion offered — if not	every seme-
			can be chosen to earn			,
		on (approx. 120 min				
		ssment: German and	d/or English			
Allocatio	on of place	es				
	1. 6					
	nal inform				<u> </u>	
this will 3 Senter find that gistratio ly registe sessmer	be consid nce 4 ASP t the stude on for asse er for an a nt was not	ered a declaration of O (general academic ent has obtained the ssment into effect. ssessment. Student put into effect will	the exercises and obt of will to seek admissi c and examination reg e qualification for adm Only those students th ts who did not register not be admitted to the ten admitted, the grad	on to assessment pu ulations). If the mod ission to assessmen nat meet the respect for an assessment of respective assessm	Irsuant to Section 20 ule coordinators sub It, they will put the s ive prerequisites car or whose registratior ent. If a student tak	o Subsection osequently student's re- n successful- n for an as- es an as-
Workloa	ıd		_			
60 h						
Teaching	g cycle					
Referred	to in LPO	I (examination reg	ulations for teaching-	degree programmes)		
§ 53 Nr § 77 Nr						
Module	appears i	n				
	-	(1 major) Mathema	-			
	-	(1 major) Physics (2 (1 major) Nanostru	2015) cture Technology (201	5)		
Bachelor's w 2015)	vith 1 major Ma	thematical Physics	-	generated 18-Apr-2025 • exa r (180 ECTS) Mathematische	-	page 95 / 118

UNIVERSITÄT WÜRZBURG

Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Functional Materials (2015) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) First state examination for the teaching degree Grundschule Physics (2015) First state examination for the teaching degree Realschule Physics (2015) First state examination for the teaching degree Gymnasium Physics (2015) First state examination for the teaching degree Mittelschule Physics (2015) Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Realschule Physics (2018) First state examination for the teaching degree Gymnasium Physics (2018) First state examination for the teaching degree Mittelschule Physics (2018) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) First state examination for the teaching degree Grundschule Physics (2020) First state examination for the teaching degree Gymnasium Physics (2020) First state examination for the teaching degree Realschule Physics (2020) First state examination for the teaching degree Mittelschule Physics (2020) Bachelor's degree (1 major) Functional Materials (2021) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Mathematics (2023) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024) Bachelor's degree (1 major) Functional Materials (2025)

Module					Abbreviation
Advand	ced and	Computational Data A	nalysis		11-P-FR2-152-m01
Module	e coord	inator		Module of	fered by
			Applied Dhysics		· · · · · · · · · · · · · · · · · · ·
	<u> </u>	ector of the Institute of			Physics and Astronomy
ECTS		od of grading	Only after succ. o	compl. of moal	lle(s)
2		successfully completed			
Duratio		Module level	Other prerequisit		
1 seme	ster	undergraduate	Students are high completing modu	•	ded to complete module 11-P-FR1 prior to
Conten	Its			···· ·	
Advanc	ced me	thods of data analysis a data analysis.	and error calculation	. Distribution	function, significance tests, modelling.
		ning outcomes			
	-		dge of the analysis o	of measuring d	ata and error calculation. They have ma
	metho	ds of computerised data			o self-obtained measuring data and to
Course	e s (type	, number of weekly con	tact hours, language	e — if other tha	an German)
V (1) +					
		sessment (type, scope, ion on whether module			examination offered — if not every sem
Exercis	ses (suc	cessful completion of a	approx. 50% of appr	ox. 10 exercise	e sheets)
Assess	ment o	ffered: Once a year, su	mmer semester		
Allocat	ion of _l	olaces			
Additio	onal inf	ormation			
Worklo	ad		_		
60 h	au				
Teachi	ng cycl	9			
reaciiii	ing cycl	e			
Poforro	d to in	LPO I (examination reg		a-degree prog	rammes)
				is acgree prog	annies)
Module	annes	ars in			
		gree (1 major) Physics (2015)		
		gree (1 major) Physics (gree (1 major) Nanostru		015)	
		gree (1 major) Mathema		-	
		gree (1 major) Mathema			
		gree (1 major) Physics (
		gree (1 major) Nanostru		020)	
		gree (1 major) Mathema			
		gree (1 major) Function	•	•	
		gree (1 major) Quantum			
		gram Physics (2023)			
exchan					
		gree (1 major) Mathema	atical Physics (2024))	

Module	title				Abbreviation
Laborat	tory Co	urse Physics B for Stude	nts of Mathematical	Physics	11-P-MPB-152-m01
Module	coord	inator		Module offered by	
Managi	ng Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	and Astronomy
ECTS		od of grading	Only after succ. com	pl. of module(s)	
4		successfully completed			
Duratio	n	Module level	Other prerequisites		
		undergraduate			mplete modules 11-P-PA and 11-
			P-FR1 prior to compl	eting module 11-P-M	IPB.
Conten					
Physica	ıl laws	of optics, vibrations and	waves, science of ele	ectricity and circuits	with electric components.
Intende	ed lear	ning outcomes			
measur princip	ring pro les of s		valuate the measurin esent and discuss the	g results on the basi conclusions.	nd to document the results in a is of error propagation and of the
P (2)					
Method		Sessment (type, scope, la on on whether module c			tion offered — if not every seme-
cessful can be candida	ly com repeat ate's u	pleted if a Testat (exam) ed once. After completion	is passed. Exactly on n of all experiments, t ics-related contents o	e experiment that wa talk (with discussion of the module. Talks	riments will be considered suc- as not successfully completed n; approx. 30 minutes) to test the that were not successfully com- uccessfully completed.
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
120 h					
Teachir	ng cycl	e			
	-				
Referre	d to in	LPOI (examination regu	lations for teaching-o	legree programmes)	
Module	appea	urs in			
		gree (1 major) Mathemati	ical Physics (2015)		
		gree (1 major) Mathemati	· · ·		
		gree (1 major) Mathemati	•		
Bachold	or's de	gree (1 major) Mathemati	ical Physics (2024)		

Modul	e title				Abbreviation
Labora	tory Co	ourse Physics C for Stude	nts of Mathematical	Physics	11-P-MPC-152-m01
Modul	e coord	inator		Module offered by	
Manag	ing Dire	ector of the Institute of A	oplied Physics	Faculty of Physics	and Astronomy
ECTS	<u> </u>	od of grading	Only after succ. con	· · · ·	
4		successfully completed			
Duratio	on	Module level	Other prerequisites	;	
		undergraduate		recommended to co	omplete module 11-P-MPB prior to
Conter	nts				
		of wave optics, Molecula ised devices with examp			rn measuring methods using spe
Intend	ed lear	ning outcomes			
by usir and dis	ng error scuss tl		cs. They are able to e and a presentation.	valuate results, to d	raffic, and to analyse the results Iraw conclusions and to present
P (2)		, ,	, 0 0		,
practic Prepar cessfu can be candid pleted	al assig ing, per lly com repeat ate's u	pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, ics-related contents	lab report) the expe e experiment that w talk (with discussion of the module. Talks	eriments will be considered suc- as not successfully completed n; approx. 30 minutes) to test the s that were not successfully com- successfully completed.
Additio	onal inf	ormation	-		
Worklo	ad				
120 h					
Teachi	ng cycl	e			
	_ ,				
Referre	ed to in	LPOI (examination regu	lations for teaching-	degree programmes)
Modul	e appea	ars in			
		gree (1 major) Mathemat	ical Physics (2015)		
		gree (1 major) Mathemat			
			•		
Dachei	or 5 uc	giee (I major) Mathemati	ical Physics (2020)		

Modul	e title				Abbreviation	
Labora	atory Co	ourse Physics A (Mechar	nics, Heat, Electromag	netism)	11-P-PA-152-m01	
Modul	e coord	inator		Module offered by	<u> </u> /	
		ector of the Institute of A	onnlied Physics	Faculty of Physics and Astronomy		
ECTS		od of grading	Only after succ. con	· · ·	and Astronomy	
3		successfully completed				
Duratio	<u> </u>	Module level	Other prerequisites			
1 seme		undergraduate				
Conter		undergraduate				
Measu rents, l	irement heat ca		sity of bodies, dynami	c viscosity, elastici	measurement of voltages an ty, surface tension, spring co	
Intend	ed lear	ning outcomes				
le to in		lently plan and conduct			rimenting techniques. They a and to document the results in	
Course	es (type	, number of weekly cont	act hours, language –	- if other than Gern	nan)	
P (2)						
		sessment (type, scope, l ion on whether module			nation offered — if not every s	seme-
pleted		repeated once. Both co			s that were not successfully o successfully o successfully completed.	
Additio	onal inf	ormation				
			_			
Worklo	oad					
90 h						
Teachi	ing cycl	e				
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programme	s)	
					- /	
Modul	e appea	ars in				
		gree (1 major) Mathema	tics (2015)			
		gree (1 major) Physics (2	-			
		gree (1 major) Nanostru	-	5)		
		gree (1 major) Mathema		-		
		gree (1 major) Computat	• -	015)		
Bachel	lor's de	gree (1 major) Aerospac	e Computer Science (2	2015)		
Bachel	lor's de	gree (1 major) Mathema	tical Physics (2016)			
		gree (1 major) Aerospac		2017)		
		gree (1 major) Physics (2		``		
Bachel	lor's de	gree (1 major) Nanostru	cture Technology (202	0)		
	s with 1 ma	jor Mathematical Physics	-	generated 18-Apr-2025 • 6		0 / 118
(2015)			ta record Bachelo	r (180 ECTS) Mathematisch	ie Physik - 2015	

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Mathematics (2023) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

Module	e title				Abbreviation	
Prepar	atory C	ourse Mathematics			11-P-VKM-152-m01	
		• -				
Module				Module offered by		
		ectors of the Institute of If Theoretical Physics ar		Faculty of Physics a	nd Astronomy	
ECTS	ECTS Method of grading Only after s			npl. of module(s)		
2	(not)	successfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts	•				
the intr 1. Basic 2. Coor 3. Vect 4. Diffe 5. Integ Intende The stu succes Course T (2) Method ster, in a) exer	roducti c geom rdinate ors - ve rential gral cal gral cal ed lear idents sfully s s (type d of ass format cises (s	nathematics and eleme on to and preparation for etry and algebra systems and complex re- ectored values calculus culus ning outcomes know the principles of re- tudying Theoretical and , number of weekly con sessment (type, scope, ion on whether module successful completion of x. 15 minutes)	or the modules of Expension numbers nathematics and elem I Experimental Physics tact hours, language – language – if other the can be chosen to earn	rimental and Theore entary calculation m - if other than Germa an German, examina a bonus)	ethods which are rea n) tion offered — if not	quired for
Allocat	ion of					
Additio	onal inf	ormation				
Worklo	ad					
60 h	uu					
Teachi	ng cycl	0				
reaciii	יוא ניינו	C				
Referre § 22 § 22 § 22 § 22	Nr. 1 h) Nr. 2 f)	LPO I (examination reg	gulations for teaching-o	degree programmes)		
<u> </u>						
Module	-	ars in				
Module Bachel	e appe a or's de	gree (1 major) Physics (-			
Module Bachel Bachel Bachel First sta First sta First sta	e appea or's de or's de or's de or's de ate exa ate exa ate exa	gree (1 major) Physics (gree (1 major) Nanostru gree (1 major) Mathema gree (1 major, 1 minor) mination for the teachi mination for the teachi mination for the teachi	cture Technology (201 atical Physics (2015) Physics (Minor, 2015) ng degree Grundschule ng degree Grundschule ng degree Realschule F	e Physics (2015) e Didactics in Physics Physics (2015)	s (Primary School) (2	015)
Module Bachel Bachel Bachel First sta First sta First sta First sta	e appea or's de or's de or's de or's de ate exa ate exa ate exa ate exa	gree (1 major) Physics (gree (1 major) Nanostru gree (1 major) Mathema gree (1 major, 1 minor) mination for the teachi mination for the teachi	cture Technology (201 atical Physics (2015) Physics (Minor, 2015) ng degree Grundschule ng degree Grundschule ng degree Realschule F ng degree Gymnasium	e Physics (2015) e Didactics in Physics Physics (2015)		015) page 102 / 118

First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2015) First state examination for the teaching degree Mittelschule Physics (2015)

First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2015) Bachelor's degree (1 major) Mathematical Physics (2016)

First state examination for the teaching degree Grundschule Physics (2018)

First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2018) First state examination for the teaching degree Realschule Physics (2018)

First state examination for the teaching degree Gymnasium Physics (2018)

First state examination for the teaching degree Mittelschule Physics (2018)

First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2018)

First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2018)

Module title Abbreviation						
Theory	of Rela	ativity			11-RTTB-232-m01	
Modul	e coord	inator		Module offered by		
-	ing Dir trophy	ector of the Institute of T sics	heoretical Physics	Faculty of Physics and Astronomy		
ECTS Method of grading Only after succ. compl. of modu						
6		rical grade				
Duratio		Module level	Other prerequisites	;		
1 seme		undergraduate				
Conter	-					
Differe Brief S Elemer Electro Field e	Mathematical Foundations Differential forms Brief Summary of the special relativity Elements of differential geometry Electrodynamics as an example of a relativistic gauge theory Field equations of the fundamental structure of general relativity Stellar equilibrium and other astrophysical applications					
		ning outcomes	_			
Familia of the f and the	arity wit formula e theor	th the basic physical and tion in terms of different of general relativity, vie llar equilibrium. First cor	tial forms. Understand ewing both of them as	ding of the formal sir gauge theories. App	nilarity between elec	ctrodynamics
Course	s (type	, number of weekly cont	act hours, language –	– if other than Germa	ın)	
V (3) + Module		t in: German or English				
		sessment (type, scope, l ion on whether module o			ition offered — if not	every seme-
 b) oral c) oral d) proj e) pres If a wri stead t of asse nation Langua 	examin examin ect repo- entatio tten exa take the essmen date at age of a	mination (approx. 90 to nation of one candidate of nation in groups (groups ort (approx. 8 to 10 page on/talk (approx. 30 minu amination was chosen a e form of an oral examina t is changed, the lecture t the latest. Issessment: German and offered: In the semester i	each (approx. 30 minu of 2, approx. 30 minu s) or tes). s method of assessm ation of one candidate r must inform student	ites per candidate) o ent, this may be cha e each or an oral exa ts about this by four	nged and assessme mination in groups. weeks prior to the o	If the method riginal exami-
	tion of				·	
Additio	onal inf	ormation				
Approv	al from	examination committee	e required			
Worklo						
180 h						
	ng cycl	e				
	0 - 9 3					
Referre	ed to in	LPOI (examination reg	 ulations for teaching-	degree programmes)		
Bachelor's (2015)	with 1 ma	jor Mathematical Physics	-	• generated 18-Apr-2025 • exa or (180 ECTS) Mathematische	-	page 104 / 118

Module appears in

Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Mathematical Physics (2020) exchange program Physics (2023)

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

Modul	e title			_	Abbreviation	
Statist	tics, Dat	a Analysis and Comput	er Physics		11-SDC-152-m01	
Modul	e coord	inator		Module offered by		
Manag		ector of the Institute of A	Applied Physics	Faculty of Physics a	and Astronomy	
ECTS		od of grading	Only after succ. co	mpl. of module(s)		
4	nume	rical grade				
Durati	on	Module level	Other prerequisite	S		
1 seme	ester	graduate				
Conter	nts					
Statist	ics. dat	a analysis and compute	r physics.			
		ning outcomes				
		nave specific and advar		field of statistics de	ata analysis and Con	nnutational
Physic					ata analysis and Con	inputationat
Course	es (type	, number of weekly con	act hours, language -	– if other than Germa	an)	
V (2) +	• •					
Modul	e taugh	t in: German or English				
		essment (type, scope, on on whether module			ition offered — if not	every seme-
		nination (approx. 90 to				
		ation of one candidate		utes) or		
		ation in groups (groups		-	r	
		ort (approx. 8 to 10 page		F, -		
		n/talk (approx. 30 mini				
lf a wri	itten exa	mination was chosen a	is method of assessm	ient, this may be cha	nged and assessme	nt may in-
		form of an oral examin			• •	
		t is changed, the lecture	er must inform studen	ts about this by four	weeks prior to the o	riginal exami-
		the latest.				
-	•	ssessment: German an ffered: Once a year, wir				
	tion of p	•				
Alloca		Jaces				
Additio	onal info	ormation				
Worklo	oad					
120 h						
Teachi	ing cycl	e				
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
Modul	le appea	irs in				
		gree (1 major) Physics (2	-			
Bachel	lor's de	gree (1 major) Nanostru	cture Technology (201	15)		
		gree (1 major) Mathema	• -			
		gree (1 major) Mathema	-			
Bachel	lor's de	gree (1 major) Physics (2	2020)			
Bachel	lor's deg	gree (1 major) Nanostru	cture Technology (202	20)		
Bachel	lor's deg	gree (1 major) Mathema	tical Physics (2020)			
		gree (1 major) Quantum				
	s with 1 maj	or Mathematical Physics		• generated 18-Apr-2025 • ex		page 106 / 118
2015)			la record bachel	or (180 ECTS) Mathematische	- HYSIK - 2015	



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

Module	e title				Abbreviation
Semina	ar Math	nematical Physics			11-SMP-152-m01
Module	e coord	inator		Module offered by	
		f examination committee	Mathematische	Faculty of Physics a	nd Astronomy
		ematical Physics)	mathematisene		na ristronomy
ECTS		od of grading	Only after succ. con	npl. of module(s)	
5		successfully completed			
Duratio		Module level	Other prerequisites		
1 seme	ster	undergraduate	Admission prerequi 85% of sessions).	site to assessment: r	regular attendance (minimum
Conten	Its				
A selec	ted top	oic of Mathematical Physi	cs.		
Intend	ed lear	ning outcomes			
	a giver	n topic on the basis of lite			olves the development and divi- ll as the ability to actively partici-
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)
S (2) Module	e taugh	t in: German or English			
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-
•		o minutes) ssessment: German and,	/or English		
Allocat	ion of _l	places			
Additio	onal inf	ormation			
this will 3 Sente find that gistrati ly regist sessmo	II be co ence 4 at the s ion for a ster for ent was	nsidered a declaration of ASPO (general academic student has obtained the assessment into effect. O an assessment. Students s not put into effect will n	will to seek admissi and examination reg qualification for adm nly those students th who did not register ot be admitted to the	on to assessment pu ulations). If the modu ission to assessmen nat meet the respecti for an assessment of respective assessm	n for admission to assessment, rsuant to Section 20 Subsection ule coordinators subsequently t, they will put the student's re- ve prerequisites can successful- or whose registration for an as- ent. If a student takes an as- sessment will not be considered.
Worklo	ad				
150 h					
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	lations for teaching-	degree programmes)	
Module	e appea	ars in			
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2015)		

Bachelor's with 1 major Mathematical Physics (2015)

Module title	Abbreviation	
Electrodynamics - Exercises	11-T-EA-152-m01	
Module coordinator	Module offered by	
Managing Director of the Institute of Theoretical Physi	· · · · · · · · · · · · · · · · · · ·	
and Astrophysics		
	compl. of module(s)	
5 numerical grade		
Duration Module level Other prerequ	sites	
1 semester undergraduate		
Contents		
Exercises in electrodynamics according to the content equations, electrostatics, magnetostatics, Maxwell ec magnetic waves, special relativity, covariant electrody	ations in matter, dynamic electromagnetic fie	
Intended learning outcomes		
The students are familiar with the mathematical meth pendently apply them to the description and solution in a physical manner.		
Courses (type, number of weekly contact hours, langu	ge — if other than German)	
Ü (2) Module taught in: Ü: German or English		
Method of assessment (type, scope, language — if ot ster, information on whether module can be chosen to		every seme-
written examination (approx. 120 minutes) Language of assessment: German and/or English		
Allocation of places		
Additional information		
Workload		
150 h		
Teaching cycle		
Referred to in LPO I (examination regulations for teac	ing-degree programmes)	
Module appears in		
Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Mathematical Physics (20 Bachelor's degree (1 major) Mathematical Physics (20 Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Mathematical Physics (20 exchange program Physics (2023)	6) 0)	
Bachelor's degree (1 major) Mathematical Physics (20	4)	

Module title		Abbreviation					
Theoretical N	lechanics			11-T-M-152-m01			
Module coordinator			Module offered by				
Managing Dir and Astrophy	ector of the Institute of T sics	Theoretical Physics	Faculty of Physics and Astronomy				
	od of grading	Only after succ. cor	npl. of module(s)				
	erical grade		• • • • •				
Duration	Module level Other prerequisites						
1 semester	undergraduate		Admission prerequisite to assessment: completion of exercises (approx.				
		13 exercise sheets per semester). Students who successfully completed					
		approx. 50% of exercises will qualify for admission to assessment. The					
		lecturer will inform	lecturer will inform students about the respective details at the beginning				
		of the semester.					
Contents	^						
ons, mechani systems and 3. Hamiltonia Poisson brack Liouville theo 4. Application electromagne ring, cross se 5. Relativistic mics: Stabilit Intended lear The students miliar with the dently apply to to interpret th Courses (type V (4) + Ü (2)	formulation: Variationa cal gauge transformatio apparent forces; n formulation: Legendre kets, canonical transform rem; Hamilton-Jacobi fo ns: Central-force problen etic field; rigid bodies, to ction [optional]; dynamics: Lorentz Trans y theory; KAM theory [op ning outcomes have gained first experi- e principles of theoretica the acquired mathematic re results. They have esp e, number of weekly cont at in: Ü: German or Englis	n; symmetries, Noeth transformation, phas nations; generator of s rmulation [optional]; ns; mechanical similar orque and inertia tenso sformation; Minkowsk tional]; deterministic ences concerning the al mechanics and thei cal methods and tech becially acquired know tact hours, language –	er theorem, cyclic co e space; Hamilton fu symmetries, conserva- rity, Virial theorem; n or, centrifugal and Eu i space; equations o chaos [optional] working methods of r different formulatio hiques to simple pro-	ordinates; accelerate inction, canonical ec ation laws; minimal ninor vibrations; par ler equations [optio f motion; 6. Non-line Theoretical Physics. ns. They are able to blems of Theoretical ematical concepts.	ed reference quations; coupling; ticles in an nal]; scatte- ear dyna- They are fa- indepen-		
	sessment (type, scope, ion on whether module			tion offered — if not	every seme-		
written examination (approx. 120 minutes) Language of assessment: German and/or English							
Allocation of	places						
Additional information							
Registration: If a student registers for the exercises and obtains the qualification for admission to assessment, this will be considered a declaration of will to seek admission to assessment pursuant to Section 20 Subsection 3 Sentence 4 ASPO (general academic and examination regulations). If the module coordinators subsequently find that the student has obtained the qualification for admission to assessment, they will put the student's registration for assessment into effect. Only those students that meet the respective prerequisites can successfully register for an assessment. Students who did not register for an assessment or whose registration for an assessment to which he/she has not been admitted, the grade achieved in this assessment will not be considered.							
Bachelor's with 1 ma (2015)	ajor Mathematical Physics	-	 generated 18-Apr-2025 exa or (180 ECTS) Mathematische 	-	page 110 / 118		

Workload

240 h

Teaching cycle

D

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

Module appears in

Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Mathematics (2023) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

Bachelor's with 1 major Mathematical Physics

(2015)

Module title				Abbreviation			
Particle Phys	ics (Standard Model)	11-TPS-152-m01					
Module coord	linator		Module offered by				
Module coordinator Managing Directors of the Institute of Applied Physics and			Faculty of Physics a	and Astronomy			
	of Theoretical Physics and		Faculty OF FITYSICS a	ind Astronomy			
	od of grading	Only after succ. con	pl. of module(s)				
	erical grade		• • • •				
Duration	Module level	Other prerequisites					
1 semester	undergraduate						
Contents							
Electroweak s parity Violatio Bhabha scatt Z-Line Shape Higgs produc Experimental ters	Theoretical description of the Standard Model Electroweak symmetry breaking through the Higgs mechanism parity Violation Bhabha scattering Z-Line Shape and forward / reverse asymmetry Higgs production and decay Experimental setup and results of key experiments to test the Standard Model and for determining its parame-						
	e Higgs boson						
	ning outcomes						
periments tha		onfirmed the standar	d model. They are al	article Physics and the key ex- ble to interpret experimental or and limits.			
Courses (type	e, number of weekly conta	ct hours, language –	- if other than Germa	in)			
V (4) + R (2) Module taugh	V (4) + R (2) Module taught in: German or English						
	sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-			
 b) oral examined c) oral examined d) project repelined e) presentation lf a written existent take the of assessmered nation date a 	a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English						
Allocation of	places						
Additional in	Additional information						
Workload	Workload						
240 h							
Teaching cyc	le						
Referred to in LPO I (examination regulations for teaching-degree programmes)							
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JMU Würzburg • generated 18-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Mathematische Physik - 2015

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Module appears in

Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major) Mathematical Physics (2024)

Module cordinator Module offered by Managing Director of the institute of Theoretical Physics and Astrophysics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compL of module(s) 8 numerical grade - Duration Module level Other prerequisite to assessment: completion of exercises (approx 13 exercise sheets per semester). Students who successfully completed approx. 50% of exercises will qualify for admission to assessment. The lecture will inform students about the respective details at the beginni of the semester. Contents - 1. History and basics: Limits of classical physics; fundamental historical experiments; from classical physics to quantum mechanics (QM): 2. Wave function and Schrödinger equation (SG): SG for free particles; superposition; probability distribution fo pulse measurement; correspondence principles: postulates of QM; Ehrenfest theorem; continuity equation; state space and Dirac notation; representations in state space; tensor products of state spaces; - Postulates O(QM) (and their interpretation). State; measurement; chronological development; energy-time ur certainy; - One-Dimensional problems: The harmonic oscillator; potential level; potential barrier; potential well; symme try properiles; - One-Dimensional problems: The harmonic scillator; potential level; controlical and kinetic momentum; Gauge transformation, Aharonov-Bohm effect; Schrödinger, Heisenberg and interaction representation; motion of a free elector in a magnetic field; - Motion in an electromagnetic field; - Motionian; Normal Zeeman effect; canonical and kinetic momentum; Gauge transf	Module	e title				Abbreviation		
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try properties; 6. Spin-1/2 systems I: Theoretical description in Dirac notation; Spin 1/2 in the homogeneous magnetic field; two-level systems (qubits); 7. Angular momentum: Commutation and rotations; eigenvalues of the angular momentum operators (abstract) solution of the eigenvalue equation in polar coordinates (concrete); 8. Central potential - hydrogen atom: Bonding states in 30; Coulomb potential; 9. Motion in an electromagnetic field: Hamiltonian; Normal Zeeman effect; canonical and kinetic momentum; Gauge transformation; Aharonov-Bohm effect; Schrödinger, Heisenberg and interaction representation; motion of a free electron in a magnetic field; 10. Spin-1/2 systems II: Formulation using angular momentum algebra; 11. Addition of angular momenta: 12. Approximation methods: Stationary perturbation theory (with examples); variational method; WKB method; time-dependent perturbation theory; 13. Atoms with several electrons: Identical particles; Helium atom; Hartree and Hartree-Fock approximation; ato mic structure and Hund's rules Intended learning outcomes The students have gained first experiences concerning the working methods of Theoretical Physics. They are fa- miliar with the principles of quantum theory. They are able to apply the acquired mathematical methods and techniques to simple problems of quantum theory and to interpret the results. They have especially acquired knowledge of advanced mathematical concepts. Courses (type, number of weekly contact hours, language — if other than German) V (4) + Ü (2) Module taught in: Ü: German or English Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Language of assessment: German and/or English Machelor's with 1 major Mathematical Physics MUU Wurzburg • generated 18-Apr-2025 • exam. reg. da- Page 114 / 182			sional problems. The h	armonic oscillator· not	ential level· notentia	al barrier· notential v	vell• svmme-	
 6. Spin-1/2 systems I: Theoretical description in Dirac notation; Spin 1/2 in the homogeneous magnetic field; two-level systems (qubits); 7. Angular momentum: Commutation and rotations; eigenvalues of the angular momentum operators (abstract) solution of the eigenvalue equation in polar coordinates (concrete); 8. Central potential - hydrogen atom: Bonding states in 3D; Coulomb potential; 9. Motion in an electromagnetic field: Hamiltonian; Normal Zeeman effect; canonical and kinetic momentum; Gauge transformation; Aharonov-Bohm effect; Schrödinger, Heisenberg and interaction representation; motion of a free electron in a magnetic field; 10. Spin-1/2 systems II: Formulation using angular momentum algebra; 11. Addition of angular momenta: 12. Approximation methods: Stationary perturbation theory (with examples); variational method; WKB method; time-dependent perturbation theory; 13. Atoms with several electrons: Identical particles; Helium atom; Hartree and Hartree-Fock approximation; atom ic structure and Hund's rules Intended learning outcomes The students have gained first experiences concerning the working methods of Theoretical Physics. They are familiar with the principles of quantum theory, and to interpret the results. They have especially acquired knowledge of advanced mathematical concepts. Courses (type, number of weekly contact hours, language — if other than German) V (4) + Ü (2) Module taught in: Ü: German or English Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Language of assessment: German and/or English Bachelor's with 1 major Mathematical Physics IMU Wurzburg • generated 18-Apr-2025 • exam. reg. da-	-		•			a burner, potentiar v	ven, symme	
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Language of assessment: German and/or English Bachelor's with 1 major Mathematical Physics JMU Würzburg • generated 18-Apr-2025 • exam. reg. da- page 114 / 118						ation offered — if not	every seme-	
Language of assessment: German and/or English Bachelor's with 1 major Mathematical Physics JMU Würzburg • generated 18-Apr-2025 • exam. reg. da- page 114 / 118	written examination (approx. 120 minutes)							
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	(2015)	with 1 life		-		-	page 114 / 118	

Allocation of places

Additional information

Registration: If a student registers for the exercises and obtains the qualification for admission to assessment, this will be considered a declaration of will to seek admission to assessment pursuant to Section 20 Subsection 3 Sentence 4 ASPO (general academic and examination regulations). If the module coordinators subsequently find that the student has obtained the qualification for admission to assessment, they will put the student's registration for assessment into effect. Only those students that meet the respective prerequisites can successfully register for an assessment. Students who did not register for an assessment or whose registration for an assessment was not put into effect will not be admitted to the respective assessment. If a student takes an assessment to which he/she has not been admitted, the grade achieved in this assessment will not be considered.

Workload

240 h

Teaching cycle

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

Module appears in

Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) Bachelor's degree (1 major, 2023) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

Module					Abbreviation		
Statist	ical Ph	ysics - Exercises			11-T-SA-152-m01		
Module	o coord	inator		Module offered by			
Module coordinator Managing Director of the Institute of Theoretical Physics			peoretical Physics	Faculty of Physics a	and Astronomy		
and As			leoreticat i fiysics		and Astronomy		
ECTS		od of grading	Only after succ. con	npl. of module(s)			
5		rical grade					
Duration Module level Other prerequisites							
1 semester undergraduate							
Conten	ts						
Among potenti	others als, qu	Principles of statistics, S	Statistical Physics, id	eal systems, fundam	e content of 11 T-SEV content. iental theorems, thermodynamic cles, approximation methods,		
Intende	ed lear	ning outcomes					
and are	e able t		em to the description		dynamics and Statistical Physics blems of Statistical Physics and		
Course	s (type	, number of weekly conta	ect hours, language –	- if other than Germa	ın)		
Ü (2)							
	_	t in: Ü: German or Englis					
		sessment (type, scope, la ion on whether module c			ition offered — if not every seme		
		nation (approx. 120 minu ssessment: German and					
Allocat	ion of _l	olaces					
Additio	nal inf	ormation					
			-				
Worklo	ad		-				
150 h							
Teachi	ng cvcl	e					
	<u> </u>						
Referre	d to in	LPOI (examination regu	lations for teaching-	degree programmes)			
Module	annes	ars in					
			015)				
Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015)							
Bachelor's degree (1 major) Mathematical Physics (2015)							
Bachelor's degree (1 major) Mathematical Physics (2016)							
Bachelor's degree (1 major) Physics (2020)							
		gree (1 major) Nanostruc		0)			
		gree (1 major) Mathemat	•				
Bachelor's degree (1 major) Quantum Technology (2021) exchange program Physics (2023)							
	Bachelor's degree (1 major) Mathematical Physics (2024)						
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Module	title				Abbreviation	
Statisti	cal Ph	ysics and Electrodynar	nics		11-T-SE-152-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Theoretical Physics and Astrophysics			Theoretical Physics	Faculty of Physics a	ind Astronomy	
1			Only offer succ. co	 mnl_ofmodulo(c)		
6		od of grading rical grade	Only after succ. co			
Ouratio		Module level	Other prerequisites	-		
2 seme:		undergraduate				
Content		undergraduate				
A. Statis o. Princ cro-stat 1. Statis closed a 2. Ideal 3. Statis ralised 4. Therr thermoo 5. Ideal se-Einsi 6. Syste ter simu 1 and 2 7. Critic BCS sup 0); prob B. Elect 0. Math tence; I 1. Maxw 2. Elect multipo ment ac 3. Magr analogi 4. Maxv 5. Dyna waves; on; tem 6. Spece effect, e 7. Cova ler effect the stur- trodyna	stical F iples of tes; pro- stical P and op syster stical F forces; modyna Syster tein co ens of ulation dimen al phe percon olems of ulation dimen al phe percon olems of codyna codyna tein co ens of ulation dimen al phe percon olems of codyna tenergy rostati ole exp coordir netostati ole exp cordir netostati ole exp coordir netostati ole exp cordir netostati ole exp cole exp cordir netostati ole	Physics; of statistics: Elements of bability space (condit hysics: Entropy and pr yen systems (with energy ns: Spin systems; linear Physics and thermodyn is the second and third amics: Thermodynamic ic machines (Carnot er ns II, quantum statistic ndensation; grids and interacting particles: A (Monte Carlo method) sions); Yang-Lee-theor nomena: Scaling laws, ductivity); magnetism of the thermodynamic laws, ductivity); magnetism of the thermodynamic laws; cal tools: Gradient, dive unction; Fourier transfor uations; cs: Coulomb's law; ele ansion; Boundary valu og to orthogonal function tics: Current density; of lectrostatics; uations in matter: Elect f electromagnetic field backets; plane waves in y oscillating sources ar ory of Relativity: Loren and momentum; co- and lectrodynamics: Field se entz force have advanced knowle thermodynamics and se ttribute them to biggen number of weekly cor	ional probability, statis obability theory; entro gy and / or particle exc ar oscillators; ideal gas amics: The 1st law; qu law; reversibility; trans c fundamentals relation gine and efficiency); c cs: Systems of identica normal modes: Phono pproximation methods ; interacting phonons f rems; Van der Waals ec critical slowing down, (quantum criticality at imit; ergence, curl; curve, su rm; full functional syst ctrostatic potential; ch e problems; numerical ons; continuity equation; ve trical and magnetic su s: Faraday induction; F n matter; cavity resona ad dipole radiation; acc trength tensor and Ma dge of the methods of tatistical mechanics. T physical contexts.	stical independence) py in classical physic hange); s; asi-static processes; ition from Statistical nship; thermodynami hemical potential; l particles; ideal Fern ns; s (mean-field theory, (Debye approximatio quation for real intera fast variable as Bad low temperatures, qu urface, volume integra tems; solving PDEs; arged interface; elect solution; Image chan ctor potential; Biot-S sceptibility; interface RCL-circuits; field ene tors and wave guides celerated point charg eity; length contractio ors; covariant classica xwell's equations; tra Theoretical Physics.	; s; thermodynamic e entropy and temper Physics to thermody ic potentials; change ni gas; ideal Bose ga Sommerfeld expans n); Ising models (pa acting gases; (electron-phonon in Jantum phase transi als; Stokes and Gau trostatic field energy rges; Green's function avart law; magnetic s; rgy and pulse; poten s; inhomogeneous w res; on and time dilation al mechanics; ansformation of the They know the princ ss the acquired theo	quilibrium in ature; gene- ynamics; es of state; as and Bo- ion); compu- rticularities in teraction and tions at T = ssian sen- (capacitor); ons; develop- moment; ntials; plane yave equati- ; light cone; fields; Dopp- iples of elec-
achelor's v	with 1 ma	jor Mathematical Physics	JMU Würzburg	• generated 18-Apr-2025 • exa	am. reg. da-	page 117 / 118
2015)			ta record Bachel	or (180 ECTS) Mathematische	Physik - 2015	

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

oral examination of one candidate each (approx. 30 minutes) Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

180 h Teaching cycle

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

Module appears in

Bachelor's degree (1 major) Physics (2015)

Bachelor's degree (1 major) Mathematical Physics (2015)

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

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

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

exchange program Physics (2023)

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

Bachelor's with 1 major Mathematical Physics	
(2015)	