

## 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: 2016 Responsible: Faculty of Mathematics and Computer Science Responsible: Institute of Mathematics Responsible: Faculty of Physics and Astronomy

JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record 82|b55|-|-|H|2016

#### 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-

Bachelor's with 1 major Mathematical Physics	JMU Würzburg • generated 19-Apr-2025 • exam. reg. da-	page 2 / 119
(2016)	ta record Bachelor (180 ECTS) Mathematische Physik - 2016	

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)):

#### 27-Jul-2016 (2016-91)

#### 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	
(2016)	

### 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-m01	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-MV-162-m01	Theoretical Mechanics	5	NUM	110
11-T-QV-162-m01	Quantum Mechanics	5	NUM	113
11-T-TMQ-162-m01	Theoretical Mechanics and Quantum Mechanics - Excercises	6	B/NB	118
Subfield Statistical Physi	cs and Electrodynamics I (6 ECTS credits)			
11-T-SE-152-m01	Statistical Physics and Electrodynamics	6	NUM	116
Subfield Statistical Physi	cs and Electrodynamics II (10 ECTS credits)			
11-T-SA-152-m01	Statistical Physics - Exercises	5	NUM	115
11-T-EA-152-m01	Electrodynamics - Exercises	5	NUM	109
Subfield Laboratory Cours	se Physics (15 ECTS credits)			
11-P-PA-152-m01	Laboratory Course Physics A (Mechanics, Heat, Electromagne- tism)	3	B/NB	100
11-P-FR1-152-m01	Data and Error Analysis	2	B/NB	95
11-P-MPB-152-m01	Laboratory Course Physics B for Students of Mathematical Phy- sics	4	B/NB	98
11-P-MPC-152-m01	Laboratory Course Physics C for Students of Mathematical Phy- sics	4	B/NB	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

Bachelor's with 1 major Mathematical Physics	JMU Würzburg • generated 19-Apr-2025 • exam. reg. da-	page 5 / 119
(2016)	ta record Bachelor (180 ECTS) Mathematische Physik - 2016	

chelor's with 1 major Mathematical 116)	Physics JMU Würzburg • generated 19-Apr-2025 • exam. re ta record Bachelor (180 ECTS) Mathematische Physi		page	e 6 / 119
11-E-O-152-m01	Optics and Waves	8	NUM	89
Module Group Experimen				
10-M-MWR-152-mo1	Modeling and Computational Science	8	NUM	50
10-M-PARP-152-m01	Physics	10	NUM	55
	Introduction to Partial Differential Equations for Mathematical			
10-M-FANP-152-m01	Introduction to Functional Analysis for Mathematical Physics	10	NUM	2
10-M-GANP-152-m01	Geometric Analysis for Mathematical Physics	10	NUM	3
10-M-FTHP-152-m01	Introduction to Complex Analysis for Mathematical Physics	10	NUM	3
10-M-DGLP-152-m01	Ordinary Differential Equations for Mathematical Physics	10	NUM	2
10-M-DGEP-152-m01	Introduction to Differential Geometry for Mathematical Physics	10	NUM	1
10-M-ORSP-152-m01	Operations Research for Mathematical Physics	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	5
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	1
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
10-M-NUM2P-152-m01	Numerical Mathematics 2 for Mathematical Physics	10	NUM	5
10-M-NUM1P-152-m01	Numerical Mathematics 1 for Mathematical Physics	10	NUM	5
	ntary Topics in Mathematics			
Mathematical Physics (18				
10-M-FAPA-PÜ-152-m01	Overview Functional Analysis and Partial Differential Equations for Mathematical Physics	13	NUM	2
10-M-GAPA-PÜ-152-mo1 for Mathematical Physics		13	NUM	4
10-M-FTPA-PÜ-152-m01	Overview Complex Analysis and Partial Differential Equations for Mathematical Physics	13	NUM	3
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	matical Physics	13	NUM	2
10-M-FAGD-PÜ-152-m01	ons for Mathematical Physics Overview Functional Analysis and Complex Analysis for Mathe-	13	NUM	2
10-M-FADG-PÜ-152-m01	thematical Physics Overview Functional Analysis and Ordinary Differential Equati-	13	NUM	2
	matical Physics Overview Functional Analysis and Differential Geometry for Ma-	_		
10-M-GAFT-PÜ-152-m01	ons for Mathematical Physics Overview Geometric Analysis and Complex Analysis for Mathe-	13	NUM	3
10-M-GAGD-PÜ-152-m01	Overview Geometric Analysis and Ordinary Differential Equati-	13	NUM	3
10-M-GADG-PÜ-152-m01	Overview Geometric Analysis and Differential Geometry for Ma- thematical Physics	13	NUM	3
-	10-M-FTGD-PÜ-152-mo1 Overview Complex Analysis and Ordinary Differential Equations for Mathematical Physics			

	·			
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-m01	Astrophysics	6	NUM	72
11-TPS-152-m01	Particle Physics (Standard Model)	8	NUM	111
11-RTTB-232-m01	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-m01	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)			
In addition to the modul transferable skills (ASQ) General Key Skills (sub		as part of t	he pool of gen	eral
10-M-TuKo-152-mo1	Exercise tutor or proof-reading in Mathematics		B/NB	66
10-M-VHB1-152-m01	E-Learning and Blended Learning Mathematics 1	5 2	B/NB B/NB	69
10-M-VHB1-152-m01	E-Learning and Blended Learning Mathematics 2	2	B/NB B/NB	
11-P-VKM-152-m01	Preparatory Course Mathematics	2	B/NB	70 102
Subject-specific Key Ski		2	БЛИВ	102
Compulsory Courses (g				
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-162-m01	Seminar Mathematical Physics	5	B/NB	108
	kills, Compulsory Electives (6 ECTS credits)	5	БЛИВ	100
10-M-SEM2-152-m01	Supplementary Seminar Mathematics		B/NB	62
10-M-JOP-152-m01	Introduction to Topology	4	B/NB	65
10-M-COM-152-m01	Computational Mathematics	5	B/NB	
10-10-2-1101	Programming course for students of Mathematics and other	4	БЛИВ	14
10-M-PRG-152-m01	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
Modul	e coord	inator		Module offered by	<u> </u>
		es Mathematik (Mathema	atics)	Institute of Mathen	natics
ECTS					
10 numerical grade					
Duratio	Puration Module level Other prere		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 <b>tion of</b>		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		
Analys	is 1			10-M-ANA1-152-m01		
Module	e coordinator		Module offered by			
Dean o	f Studies Mathematik (Mathema	atics)	Institute of Mathem	atics		
ECTS	Method of grading	Only after succ. con	npl. of module(s)			
8	(not) successfully completed					
Duratio	on Module level	Other prerequisites				
1 seme	ster undergraduate					
Conten	its					
ries; po	Real numbers and completeness; basic topological notions; convergence and divergence of sequences and se- ries; power series and Taylor series; basics in differential calculus in one variable; basics of integral calculus in one variable (Riemann integral and improper integral).					
Intende	ed learning outcomes					
central		can employ 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	<b>s</b> (type, number of weekly conta	act hours, language –	- if other than Germa	n)		
V (4) +	Ü (2)					
ster, in written	formation on whether module c	an be chosen to earn	a bonus)	tion offered — if not every seme- 12 exercise sheets with approx. 4		
Langua	ge of assessment: German and	/or English				
Allocat	ion of places					
Additio	onal information					
Worklo	ad					
240 h						
	ng cycle	-				
Referre	ed to in LPO I (examination regu	lations for teaching-	degree programmes)			
			<u> </u>			
Module	e appears in					
Bachel	or's degree (1 major) Mathemat	ics (2015)				
	or's degree (1 major) Economatl					
	Bachelor's degree (1 major) Mathematical Physics (2015)					
	or's degree (1 major) Computati		015)			
	or's degree (1 major) Mathemat	•				
	or's degree (1 major) Economatl					
	or's degree (1 major) Economatl					
	ige program Mathematics (2023					
Bachel	or's degree (1 major) Mathemat	ics (2023)				

	e title				Abbreviation
Overvi	ew Ana	lysis for Mathematical	Physics		10-M-ANP-Ü-152-m01
Modul	e coord	linator		Module offered by	<u> </u>
Dean of Studies Mathematik (Mathematics)		natics)	Institute of Mather	natics	
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)	
12	nume	rical grade			
Duration Module level Ot		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 <b>tion of</b> [	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 <b>tion of</b> [	ion on whether module ion of one candidate ea vill have reference to the issessment: German an <b>places</b>	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 <b>places</b>	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 <b>places</b>	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 <b>places</b> 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 <b>places</b> 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 <b>places</b> 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 ti	tle			Abbreviation		
Reasoning	g and Writing in Mathemati	cs		10-M-ASM-152-m01		
	pordinator		Module offered by			
	tudies Mathematik (Mathen	- <u>-</u>	Institute of Mathem	atics		
	ethod of grading	Only after succ. con	pl. of module(s)			
2 (n	ot) successfully completed					
Duration	Module level	Other prerequisites				
1 semeste	er undergraduate					
Contents						
	on to fundamental methods Il writing;insight into examp					
Intended	learning outcomes					
	nt is acquainted with the ba mathematical arguments in					
Courses (t	type, number of weekly con	act hours, language –	- if other than Germa	n)		
V (1) + Ü (1	1)					
	f assessment (type, scope,	 language — if other tha	an German, examina	tion offered — if not	every seme-	
	mation on whether module	0 0			,	
	o to 20 pages)					
	of assessment: German an	d/or English				
Allocation	of places					
Additiona	linformation					
Workload						
60 h						
Teaching	cycle					
<u>0</u>	·					
Poforrod t	o in LPO I (examination reg	ulations for teaching	legree programmes)			
Keleneut						
	•					
Module a						
	s degree (1 major) Mathema					
	s degree (1 major) Economa					
	s degree (1 major) Mathema					
	s degree (1 major) Computa s degree (1 major) Mathema		J15)			
	s degree (1 major) Mathema s degree (1 major) Economa	•				
	s degree (1 major) Economa s degree (1 major) Mathema					
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)						
	s degree (1 major) Mathema		22)			
	program Mathematics (202		,			
-	Bachelor's degree (1 major) Mathematics (2023)					
	s degree (1 major) Economa					
	s degree (1 major) Mathema					
		IMII Würzburg	generated 19-Apr-2025 • exa	an and de	· · · · ·	
Bachelor's with	1 major Mathematical Physics		generaleu 19-Aur-2025 • PAG	im. reg. da-	page 11 / 119	



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

Modul					Abbreviation	
Bache	lor The	sis Mathematical Physics	5		10-M-BAP-152-m01	
Modul	e coord	linator		Module offered by		
Dean c	Dean of Studies Mathematik (Mathematics)		atics)	Institute of Mathem	natics	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
10	nume	rical grade	l grade			
Duratio	ration Module level Other prereq		Other prerequisites			
1 seme	ester	undergraduate	Where applicable, to	opic-specific module	es 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				
		<b>sessment</b> (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			
Compu	Itationa	l Mathematics			10-M-COM-152-mo1		
Modul	e coord	inator		Module offered by			
			· - +:)				
		es Mathematik (Mathem		Institute of Mathem	latics		
ECTS		od of grading	Only after succ. con	r succ. compl. of module(s)			
4	1	successfully completed					
Duratio		Module level	Other prerequisites				
1 seme		undergraduate					
Conter							
		o modern mathematical utation (e. g. Matlab) to					
	and 10-M-LNA-G). Computer-based solution of problems in linear algebra, geometry, analysis, in particular diffe- rential and integral calculus; visualisation of functions.						
		ning outcomes					
The stu	udent le	arns the use of advance	ed modern mathemati	cal software package	es, and is able to as	sess their	
fields o	of appli	cation to solve mathem	atical problems.				
Course	<b>es</b> (type	, number of weekly cont	act hours, language –	- if other than Germa	in)		
V (1) +	Ü (2)						
		sessment (type, scope, l			tion offered — if not	every seme-	
-	-	on on whether module					
		form of programming ex		25 hours)			
-	-	ssessment: German and ffered: Once a year, win					
	tion of j						
		Jaces					
Additid	nal inf	ormation	_				
Auditit							
Worklo	ad						
120 h	<u>, au</u>		_				
_	ng cycl	•	_				
reacin	iis cyci		_				
Referre	ed to in	LPO I (examination reg	ulations for teaching.	legree programmes)			
§ 22							
	e appea	are in					
			tion (n. n. n.)				
		gree (1 major) Mathema					
		gree (1 major) Physics (2 gree (1 major) Nanostru	-	-)			
		gree (1 major) Ranostru					
1		gree (1 major) Economa gree (1 major) Mathema					
			• •	<b>71</b> E)			
1	Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Functional Materials (2015)						
	First state examination for the teaching degree Gymnasium Mathematics (2015)						
		gree (1 major) Mathema	,				
1		gree (1 major) Economa	•				
		mination for the teachir		Mathematics (2010)			
		gree (1 major) Physics (2	,				
		gree (1 major) Nanostru		o)			
		or Mathematical Physics		generated 19-Apr-2025 • exa	am. reg. da-	page 14 / 119	
(2016)		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	-	r (180 ECTS) Mathematische	-	,,	

#### Julius-Maximilians-UNIVERSITÄT WÜRZBURG

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 title					Abbreviation	
Introduction to Differential Geometry					10-M-DGE-152-m01	
Module coordinator				Module offered by		
Dean o	f Studi	es Mathematik (Mathema	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	<b>s</b> (type	, number of weekly conta	act hours, language –	- if other than Germa	an)	
V (4) +	Ü (2)					
ster, in	formati	<b>Sessment</b> (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	-			
		• • • •	,	015)		
Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Mathematical Physics (2016)						
	Bachelor's degree (1 major) Mathematics (2023)					

	e title				Abbreviation	
Introduction to Differential Geometry for Mathematical Phy				sics	10-M-DGEP-152-m01	
Module coordinator				Module offered by	Module offered by	
		es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS	1	od of grading	Only after succ. con		latics	
10	1	rical grade				
Duratio		Module level	Other prerequisites			
1 seme		undergraduate				
Conten						
Curves particu	in Euc lar) in l		ture of hypersurfaces,		bmanifolds (hypersurfaces in es, main theorem on local sur-	
Intende	ed lear	ning outcomes				
	ed with				erential geometry. He/She is ac- ental proof methods indepen-	
Course	<b>s</b> (type	, number of weekly cont	act hours, language –	if other than Germa	in)	
V (4) +	Ü (2)					
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) a) oral examination of one candidate each (15 to 30 minutes) or b) oral examination in groups of 2 candidates (10 to 15 minutes each) Assessment will have reference to a topic in pure mathematics as agreed upon with the examiner. Each topic may only be selected as the subject of one examination in the sub-field Gesamtüberblick Mathematische Methoden (Overview Mathematical Methods) or in module group Ergänzung Mathematik (Supplementary Topics in Mathematics). Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus Allocation of places						
				offered and in the s	ubsequent semester	
		places		offered and in the s	ubsequent semester	
	onal inf	places		offered and in the s	ubsequent semester	
 Additio 	onal inf	places		offered and in the s	ubsequent semester	
 Additio  Worklo	onal inf oad	ormation		offered and in the s	ubsequent semester	
 Additio  Worklo 300 h	onal inf oad	ormation		offered and in the su	ubsequent semester	
 Additio  Worklo 300 h Teachir	onal inf oad ng cycl	places formation				
 Additio  Worklo 300 h Teachir	onal inf oad ng cycl	ormation				
 Additio  300 h Teachir  Referre	onal inf bad ng cycl ed to in	places formation e LPOI (examination reg				
 Additio  300 h Teachir  Referre  Module	onal inf oad ng cycl ed to in	places formation e LPO I (examination reg	ulations for teaching-o			
 Additio  300 h Teachir  Referre  Bacheld	onal inf oad ng cycl ed to in e appea or's de	places formation e LPO I (examination reg ars in gree (1 major) Mathemation	ulations for teaching-o			
 Additio  300 h Teachir  Referre  Bacheld Bacheld	ed to in ead or's de or's de	places formation e LPO I (examination reg	ulations for teaching-o			

Module	e title		, ,		Abbreviation				
Overvie	Overview Differential Geometry and Ordinary Differential Equations for Mathe				10-M-DGGD-PÜ-152-m01				
matica	l Physi	cs							
Module coordinator Mo				Module offered by					
Dean o	f Studi	es Mathematik (Mathema	atics)	nstitute of Mathem	atics				
ECTS	Methe	od of grading	Only after succ. com	ol. of module(s)					
13	nume	rical grade							
Duratio	on	Module level	Other prerequisites						
1 seme	ster	undergraduate							
Conten	Its								
particu face th	lar) in I eory, s initial	Euclidean spaces, curvat pecial classes of surfaces values, systems of linear	ure of hypersurfaces, g s; existence and uniqu	eodesics, isometri eness theorem, cor	bmanifolds (hypersurfaces in es, main theorem on local sur- ntinuous dependence of soluti- Il series, linear differential equati				
Intende	ed lear	ning outcomes							
dinary	differei		s able to relate these o	oncepts with one a	al geometry and the theory of or- mother, and realises the advan-				
Course	<b>s</b> (type	, number of weekly conta	act hours, language —	if other than Germa	n)				
V (4) +	Ü (2)								
		<b>sessment</b> (type, scope, la ion on whether module c			tion offered — if not every seme-				
Assess may on den (Ov themat	ment w nly be s verview tics).	elected as the subject of	topics in pure mathem one examination in th or in module group Er	e sub-field Gesamt	on with the examiner. Each topic überblick Mathematische Metho- tik (Supplementary Topics in Ma-				
Allocat	ion of <sub>l</sub>	places							
Additio	onal inf	ormation							
Worklo	ad								
390 h			-						
Teachi	ng cycl	e							
	- /								
Referre	ed to in	LPOI (examination regu	llations for teaching-de	egree programmes)					
				<u> </u>					
Module	e annes	ars in							
			ical Physics (2015)						
Duchet			Bachelor's degree (1 major) Mathematical Physics (2015)						
Bachel	or's de	gree (1 major) Mathemati	• •	Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Mathematical Physics (2016)					
		gree (1 major) Mathemati gree (1 major) Mathemati	ical Physics (2016)						

Module title					Abbreviation
Ordina	ry Diffe	erential Equations			10-M-DGL-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)	
9	(not)	successfully completed			
Duratio	on	Module level	Other prerequisites		
1 seme	ester	undergraduate			
Conten	nts				
		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	•		neory of ordinary differential
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	in)
V (4) +	Ü (2)				
a) writt b) oral c) oral	en exa examir examin age of a ble for		80 minutes, usually ach (15 to 30 minutes of 2, 10 to 15 minutes	chosen) or s) or	
Additio	onal inf	ormation			
Worklo	oad				
270 h					
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	lations for teaching-o	degree 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) Computati gree (1 major) Mathemati gree (1 major) Mathemati	cal Physics (2015) onal Mathematics (20 cal Physics (2016)	D15)	

	e title				Abbreviation
Ordinary Differential Equations for Mathematical Physics			thematical Physics		10-M-DGLP-152-m01
Module coordinator				Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	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	i	
1 seme	ster	undergraduate			
Conten	Its				
ferentia	al equa	tions; matrix exponentia			itial values; systems of linear dif- igher order.
		ning outcomes			
		acquainted with the fun /she is able to apply the	•		heory of ordinary differential
Course	<b>s</b> (type	, number of weekly conta	act hours, language –	- if other than Germa	an)
V (4) +	Ü (2)				
		<b>sessment</b> (type, scope, la ion on whether module c			ation offered — if not every seme
Assess may or	examir ment w nly be s	nation in groups of 2 cand vill have reference to a to elected as the subject of	pic in pure mathemat one examination in t	utes each) tics as agreed upon he sub-field Gesam	
Assess may or den (O <sup>r</sup> themat	examir ment w nly be s verview tics). age of a	nation in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and	didates (10 to 15 minu pic in pure mathemat one examination in t or in module group I	utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O themat Langua	examir ment w nly be s verview tics). age of a ble for	nation in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus	didates (10 to 15 minu pic in pure mathemat one examination in t or in module group I	utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O themat Langua credita	examir ment w nly be s verview tics). age of a ble for	nation in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus	didates (10 to 15 minu pic in pure mathemat one examination in t or in module group I	utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
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 in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus	didates (10 to 15 minu pic in pure mathemat one examination in t or in module group I	utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
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 in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus blaces	didates (10 to 15 minu pic in pure mathemat one examination in t or in module group I	utes each) tics as agreed upon he sub-field Gesam	with the examiner. Each topic tüberblick Mathematische Metho tik (Supplementary Topics in Ma
Assess may or den (O themat Langua credita Allocat	examir ment w nly be s verview tics). age of a ble for <b>ion of p</b>	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	didates (10 to 15 minu pic in pure mathemat one examination in t or in module group I	utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O themat Langua credita Allocat  Additic	examir ment w nly be s verview tics). age of a ble for <b>ion of p</b>	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	didates (10 to 15 minu pic in pure mathemat one examination in t or in module group I	utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O' themat Langua credita Allocat  Additio  Worklo 300 h	examir ment w nly be s verview tics). age of a 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 bonus <b>blaces</b>	didates (10 to 15 minu pic in pure mathemat one examination in t or in module group I	utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O' themat Langua credita Allocat  Additic  Worklo	examir ment w nly be s verview tics). age of a 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 bonus <b>blaces</b>	didates (10 to 15 minu pic in pure mathemat one examination in t or in module group I	utes each) tics as agreed upon he sub-field Gesam	tüberblick Mathematische Metho
Assess may or den (O' themat Langua credita Allocat  Additio  300 h Teachin 	examir ment w nly be s verview tics). age of a 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 bonus <b>blaces</b>	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 upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho atik (Supplementary Topics in Ma
Assess may or den (O' themat Langua credita Allocat  Additio  300 h Teachin 	examir ment w nly be s verview tics). age of a ble for tion of p onal inf	ation 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	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 upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho atik (Supplementary Topics in Ma
Assess may or den (O' themat Langua credita Allocat  Additio  300 h Teachin  Referre	examir ment w nly be s verview tics). age of a ble for tion of p onal inf pad	e LPOI (examination regu	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 upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho atik (Supplementary Topics in Ma
Assess may or den (O themat Langua credita Allocat  Additic  Worklo 300 h Teachi  Referre  Modulo	examir ment w nly be s verview tics). age of a ble for <b>ion of p</b> <b>onal inf</b> <b>onal inf</b> <b>oad</b> <b>ng cycl</b> <b>ed to in</b>	e LPOI (examination regu	didates (10 to 15 minu pic in pure mathemation one examination in t or in module group f /or English	utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho atik (Supplementary Topics in Ma
Assess may or den (O' themat Langua credita Allocat  Additio  300 h Teachin  Referre Bachel	examir ment w aly be s verview tics). age of a ble for tion of p onal inf onal inf onal inf onal inf 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 bonus blaces ormation e LPO I (examination regu	didates (10 to 15 minu pic in pure mathemation one examination in t ) or in module group f /or English 	utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho atik (Supplementary Topics in Ma
Assess may or den (O' themat Langua credita Allocat  Worklo 300 h Teachi  Referre 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	action in groups of 2 cand vill have reference to a to elected as the subject of v Mathematical Methods) ssessment: German and bonus olaces ormation e LPO I (examination regu ars in gree (1 major) Mathemati	didates (10 to 15 minu pic in pure mathemation one examination in t or in module group I /or English ilations for teaching-o ical Physics (2015) ical Physics (2016) ical Physics (2020)	utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	tüberblick Mathematische Metho 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 coordinator				Module offered by	Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathen	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					
particu face th ons of probler	lar) in E eory, sp first orc ms, ma	Euclidean spaces, curvation pecial classes of surfaces ler, existence and unique ximum principle and Dirion	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- ematical physics, boundary value	
Intend	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	<b>s</b> (type	, number of weekly conta	ct hours, language —	· if other than Germa	an)	
V (4) +	Ü (2)					
		<b>essment</b> (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	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)			
		gree (1 major) Mathemati	• -			
		gree (1 major) Mathemati	•			
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2024)			

Module title				Abbreviation		
Introduction to Discrete Mathematics for Mathematical Phy			cs for Mathematical Phy	ysics	10-M-DIMP-152-m01	
Module coordinator				Module offered by	Module offered by	
Dean o	of Studi	es Mathematik (Mathe	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	i		
1 seme	ster	undergraduate				
Conten	Its					
		om combinatorics, inti ng 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	pply methods from num f discrete structures.	nber theory and alge	e mathematics, masters the re- bra to discrete mathematics and	
		, number of weekly co	ntact hours, language –	- If other than Germa	an)	
V (4) +						
			, language — if other th e can be chosen to earn		ation offered — if not every seme	
b) oral c) oral	examin examir age of a	nation of one candidat nation in groups (group assessment: German a	o 180 minutes, usually e each (15 to 30 minute os of 2, 10 to 15 minutes nd/or English	s) or		
Allocat	ion of	places				
Additic	onal inf	ormation				
Worklo	ad					
300 h						
300 h <b>Teachi</b>	ng cycl	e				
	ng cycl	e				
Teachi 			egulations for teaching-	degree programmes	)	
Teachi 			egulations for teaching-o	degree programmes	)	
Teachi  Referre	ed to in	LPOI (examination re	egulations for teaching-o	degree programmes	)	
Teachi  Referre  Module	ed to in e appea	LPOI (examination re		degree programmes	)	
Teachi  Referre  Module Bachel	ed to in e appea or's de	LPOI (examination re	natical Physics (2015)	degree programmes	)	
Teachi  Referre  Module Bachel Bachel	ed to in e appea or's de or's de	LPOI (examination re ars in gree (1 major) Mathem	natical Physics (2015) natical Physics (2016)	degree programmes	)	

Module					Abbreviation	
Overvi	ew Fun	ctional Analysis and Di	fferential Geometry for	Mathematical Phy-	10-M-FADG-PÜ-152-m01	
sics					5	
Module coordinator				Module offered by	Module offered by	
Dean o	of Studi	es Mathematik (Mather	natics)	Institute of Mathem	atics	
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					
spaces	s, curva s, curva	ture, Frenet equations,	local classification, su	bmanifolds (hypersu	analysis; curves in Euclidean Irfaces in particular) in Euclidean al surface theory, special classes	
Intend	ed lear	ning outcomes				
lysis. H the bor	le/She rders of	is able to relate these of f different branches in r	concepts with one anot nathematics.	her, and realises the	al geometry and functional ana- advantages of thinking across	
Course	<b>s</b> (type	, number of weekly con	tact hours, language –	- if other than Germa	n)	
V (4) +	Ü (2)					
ster, in oral ex- Assess may or den (O themat	format aminat ment v nly be s verviev tics).	ion on whether module ion of one candidate ea vill have reference to tw elected as the subject o	can be chosen to earn ach (20 to 40 minutes) to 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	tion offered — if not every seme- on with the examiner. Each topic überblick Mathematische Metho tik (Supplementary Topics in Ma-	
Allocat			<u> </u>			
Additio	nal inf	ormation				
Additio	onal inf	ormation				
		ormation				
 Workla		ormation				
 <b>Worklo</b> 390 h	ad					
 Workla	ad					
 Worklo 390 h Teachi	oad ng cycl	e				
 Worklo 390 h Teachi	oad ng cycl		gulations for teaching-o	degree programmes)		
 Worklo 390 h Teachi	oad ng cycl	e	gulations for teaching-o	degree programmes)		
 Worklo 390 h Teachi	ng cycl ed to in	e LPOI (examination reg	gulations for teaching-o	degree programmes)		
 Worklo 390 h Teachin  Referre  Modulo	oad ng cycl ed to in e appea	e LPOI (examination reg		degree programmes)		
 Worklo 390 h Teachii  Referre  Module Bachel Bachel	ng cycl ed to in e appea or's de or's de	e LPO I (examination reg ars in gree (1 major) Mathema gree (1 major) Mathema	atical Physics (2015) atical Physics (2016)	degree programmes)		
 Workla 390 h Teachin  Referre  Module Bachel Bachel Bachel Bachel	ad ng cycl ed to in e appea or's de or's de or's de	e LPOI (examination reg ars in gree (1 major) Mathema	atical Physics (2015) atical Physics (2016) atical Physics (2020)	degree programmes)		

Module	e title				Abbreviation	
Overview Functional Analysis and Complex Analysis for Mathen			thematical Physics	10-M-FAFT-PÜ-152-m01		
Module coordinator				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 eo	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	epts with one anothe matics.	er, and realises the a	al analysis and complex analy- advantages of thinking across the	
		, number of weekly conta	ct hours, language —	f other than Germa	in)	
V (4) +						
		<b>sessment</b> (type, scope, la on on whether module ca			tion offered — if not every seme-	
Assess may or den (O themat	ment w Ily be s verview ics).	elected as the subject of	topics in pure mather one examination in th 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				
Worklo	ad					
390 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination regu	lations for teaching-d	legree programmes)		
Module	e appea	ars in				
Bachel	Bachelor's degree (1 major) Mathematical Physics (2015)					
		gree (1 major) Mathemati gree (1 major) Mathemati				
Bachel Bachel	or's de or's de		cal Physics (2016) cal Physics (2020)			

· ·	e title				Abbreviation
Overview Functional Analysis and Geometric Analysis for Ma			eometric Analysis for M	Aathematical Phy-	10-M-FAGA-PÜ-152-m01
sics					
Module coordinator				Module offered by	
Dean o	of Studi	es Mathematik (Mathe	ematics)	Institute of Mather	natics
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)	
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites	j	
1 seme	ester	undergraduate			
Conten	nts				
	manifo	lds, submanifolds, cal			analysis; fundamentals in analy and applications in vector analy
Intend	ed lear	ning outcomes			
sis. He	/She is		oncepts with one anoth		al analysis and geometric analy- advantages of thinking across the
Course	<b>es</b> (type	, number of weekly co	ntact hours, language –	- if other than Germa	an)
V (4) +	Ü (2)				
			e, language — if other th e can be chosen to earn		ation offered — if not every seme-
Assess may or	sment v nly be s	vill have reference to t		ematics as agreed up	oon with the examiner. Each topic
themat	tics).	v Mathematical Metho	ds) or in module group		
themat Langua	tics). age of a	v Mathematical Metho assessment: German a	ds) or in module group		tüberblick Mathematische Metho ttik (Supplementary Topics in Ma
themat	tics). age of a	v Mathematical Metho assessment: German a	ds) or in module group		
themat Langua Allocat	tics). age of a t <b>ion of</b>	v Mathematical Metho Issessment: German a <b>places</b>	ds) or in module group		
themat Langua Allocat	tics). age of a t <b>ion of</b>	v Mathematical Metho assessment: German a	ds) or in module group		
themat Langua Allocat  Additic 	tics). age of a tion of onal inf	v Mathematical Metho Issessment: German a <b>places</b>	ds) or in module group		
themat Langua Allocat  Additic  Worklo	tics). age of a tion of onal inf	v Mathematical Metho Issessment: German a <b>places</b>	ds) or in module group		
themat Langua Allocat  Additic  Worklo 390 h	tics). age of a tion of pnal inf	v Mathematical Metho issessment: German a places formation	ds) or in module group		
themat Langua Allocat  Additic  Worklo	tics). age of a tion of pnal inf	v Mathematical Metho issessment: German a places formation	ds) or in module group		
themat Langua Allocat  Additic  Worklo 390 h	tics). age of a tion of pnal inf	v Mathematical Metho issessment: German a places formation	ds) or in module group		
themat Langua Allocat  Additic  Worklo 390 h Teachi 	tics). age of a tion of onal inf oad	v Mathematical Metho issessment: German a places formation	ds) or in module group	Ergänzung Mathema	itik (Supplementary Topics in Ma
themat Langua Allocat  Additic  Worklo 390 h Teachi 	tics). age of a tion of onal inf oad	v Mathematical Metho issessment: German a places formation	ds) or in module group nd/or English	Ergänzung Mathema	itik (Supplementary Topics in Ma
themat Langua Allocat  Additio  390 h Teachi  Referre	tics). age of a tion of onal inf oad ng cycl	v Mathematical Metho issessment: German a places formation e LPO I (examination re	ds) or in module group nd/or English	Ergänzung Mathema	itik (Supplementary Topics in Ma
themat Langua Allocat  Worklo 390 h Teachi  Referre  Modulo	tics). age of a tion of onal inf oad ng cycl ed to in	v Mathematical Metho issessment: German a places formation e LPO I (examination re ars in	ds) or in module group nd/or English	Ergänzung Mathema	itik (Supplementary Topics in Ma
themat Langua Allocat  Additic  Worklo 390 h Teachi Teachi  Referre  Bachel	tics). age of a tion of onal inf oad ng cycl ed to in e appea lor's de	v Mathematical Metho assessment: German a places formation e LPO I (examination re ars in gree (1 major) Mathen	ds) or in module group nd/or English	Ergänzung Mathema	itik (Supplementary Topics in Ma
themat Langua Allocat  Additic  Worklo 390 h Teachi  Referro Bachel Bachel Bachel	tics). age of a tion of onal inf oad ng cycl ed to in e appea lor's de lor's de	v Mathematical Metho issessment: German a places formation e LPO I (examination re ars in	ds) or in module group nd/or English 	Ergänzung Mathema	itik (Supplementary Topics in Ma

Module	e title				Abbreviation	
<b>Overview Functional Analysis and Ordinary Differential Equ</b>				ations for Mathe-	10-M-FAGD-PÜ-152-m01	
matica	l Physi	cs				
Module coordinator				Module offered by	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	Duration Module level Other prerequisit					
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	<b>s</b> (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	tations 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 title					Abbreviation
Introduction to Functional Analysis					10-M-FAN-152-m01
Module coordinator				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	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
V (4) +	Ü (2)				
		<b>essment</b> (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	Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) First state examination for the teaching degree Gymnasium Mathematics (2015) Bachelor's degree (1 major) Mathematical Physics (2016) First state examination for the teaching degree Gymnasium Mathematics (2019) First state examination for the teaching degree Gymnasium Mathematics (2019) First state examination for the teaching degree Gymnasium Mathematics (2023) Bachelor's degree (1 major) Mathematics (2023)				

Modul					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	f 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	ster	undergraduate			
Conten	Its				
Banacł	n space	s and Hilbert spaces, bo	unded operators, prir	nciples of functional	l analysis.
Intend	ed lear	ning outcomes			
metho	ds, is a		n linear algebra and	analysis to function	sis as well as the pertinent proof al analysis, and realises the
Course	<b>s</b> (type	, number of weekly conta	ict hours, language —	- if other than Germa	an)
V (4) +	Ü (2)				
					ation offered — If not every seme
a) oral b) oral Assess may or den (O themat Langua credita	examir examir ment w nly be s verview tics).	on on whether module c ation of one candidate e nation in groups of 2 cand vill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	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	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 <b>Allocat</b>	examir examir ment w nly be s verview tics). age of a ble for <b>:ion of j</b>	on on whether module c ation of one candidate e nation in groups of 2 cand vill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	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	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 <b>Allocat</b>	examir examir ment w nly be s verview tics). age of a ble for <b>:ion of j</b>	on on whether module c ation of one candidate e nation in groups of 2 cand vill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	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	a bonus) s) or utes each) tics as agreed upon he sub-field Gesam	ation offered — if not every seme with the examiner. Each topic tüberblick Mathematische Metho atik (Supplementary Topics in Ma
a) oral b) oral Assess may or den (O themat Langua credita <b>Allocat</b>	examir examir ment w ily be s verview tics). age of a ble for tion of p	on on whether module c ation of one candidate e nation in groups of 2 cand vill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	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	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 <b>Allocat</b>	examir examir ment w ily be s verview tics). age of a ble for tion of p	on on whether module c ation of one candidate e nation in groups of 2 cand vill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	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	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 <b>Allocat</b>  <b>Additic</b>  <b>Worklo</b> 300 h	examir examir ment w ily be s verview tics). age of a ble for tion of p	on on whether module contained on on on ecandidate entition of one candidate entition in groups of 2 candrill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	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	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 <b>Allocat</b>  <b>Additic</b>  <b>Worklo</b> 300 h	examir examir ment w ily be s verview tics). age of a ble for tion of p onal inf	on on whether module contained on on on ecandidate entition of one candidate entition in groups of 2 candrill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	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	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 Teachi	examir examir ment w nly be s verview tics). age of a ble for tion of p onal inf	on on whether module contained on on whether module contained of one candidate entition in groups of 2 candidite in a contract of the subject of the matical Methods) seessment: German and bonus bolaces bormation	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) 5) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	with the examiner. Each topic tüberblick Mathematische Metho atik (Supplementary Topics in Ma
a) oral b) oral Assess may or den (O themat Langua credita Allocat  Morklo 300 h Teachi	examir examir ment w nly be s verview tics). age of a ble for tion of p onal inf	on on whether module contained on on on ecandidate entition of one candidate entition in groups of 2 candrill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus	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) 5) or utes each) tics as agreed upon he sub-field Gesam Ergänzung Mathema	with the examiner. Each topic tüberblick Mathematische Metho atik (Supplementary Topics in Ma
a) oral b) oral Assess may or den (O themat Langua credita Allocat  Morklo 300 h Teachi  Referre	examir examir ment w nly be s verview tics). age of a ble for <b>cion of p</b> <b>conal inf</b> <b>conal inf</b>	on on whether module contained on on whether module contained of one candidate entition in groups of 2 candidite in a contract of the subject of the matical Methods) assessment: German and bonus bolaces bormation entities of the subject of the su	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) 5) 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  Additio  Book Teachi  Referre	examir examir ment w hly be s verview tics). age of a ble for tion of p onal inf pad	on on whether module c ation of one candidate e lation in groups of 2 cand ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus olaces 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) 5) 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 Bachel	examir examir ment w ily be s verview tics). age of a ble for <b>ion of p</b> <b>onal inf</b> <b>onal inf</b> <b>oad</b> <b>ng cycl</b> <b>ed to in</b> <b>e appea</b> or's de	on on whether module contained on on whether module contained of one candidate entition in groups of 2 candidite entition in groups of 2 candidite entition and belacted as the subject of Mathematical Methods) assessment: German and bonus belaces between the subject of the sub	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) 5) 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	examir examir ment w nly be s verview tics). age of a ble for <b>cion of j</b> <b>conal inf</b> <b>conal inf</b> <b>con</b>	on on whether module c ation of one candidate e lation in groups of 2 cand ill have reference to a to elected as the subject of Mathematical Methods) ssessment: German and bonus olaces 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 f /or English /or English llations for teaching-o	a bonus) 5) 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 Fun	ctional Analysis and Part	ial Differential Equati	ions for Mathemati-	10-M-FAPA-PÜ-152-m01
cal Phy	/sics				
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Meth	od of grading	Only after succ. com	pl. of module(s)	
13	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	Its				
ferentia	al equa	tions and partial differen	tial equations of first	order, existence and	analysis; examples of partial dif- d uniqueness theorems, basic ble and Dirichlet problem.
Intende	ed lear	ning outcomes			
tial diff	ferentia		ble to relate these con	ncepts with one ano	Il analysis and the theory of par- ther, and realises the advantages
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
V (4) +	Ü (2)				
		<b>sessment</b> (type, scope, la ion on whether module c			tion offered — if not every seme-
Assess may on den (Ov themat	ment w nly be s verview tics). age of a	elected as the subject of / Mathematical Methods) ssessment: German and	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-
Additio	onal inf	ormation			
Worklo	ad				
390 h					
Teachi	ng cycl	e			
Teachi 	ng cycl	e			
		e LPOI (examination regu	lations for teaching-c	legree programmes)	
			lations for teaching-c	legree programmes)	
 Referre	ed to in	LPOI (examination regu	lations for teaching-c	legree programmes)	
 Referre  Module	ed to in e appea	LPOI (examination regu		legree programmes)	
 Referre  Module Bachel	ed to in e appea or's de	LPOI (examination regu	cal Physics (2015)	legree programmes)	
 Referre  Module Bachel Bachel	ed to in e appea or's de or's de	LPOI (examination regu ars in gree (1 major) Mathemati	cal Physics (2015) cal Physics (2016)	legree 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 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							
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	<b>s</b> (type	, number of weekly conta	ict hours, language —	if other than Germa	ın)			
V (4) +	Ü (2)							
		<b>essment</b> (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)					
		gree (1 major) Mathemati						
Bachel	or 5 uc	giee (I majoi) mameman	Bachelor's degree (1 major) Mathematical Physics (2020)					

	e title				Abbreviation
	ew Com	plex Analysis and Ordin	ary Differential Equat	ions for Mathema-	10-M-FTGD-PÜ-152-m01
tical Ph	nysics				
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	Its				
rems, is erstraß continu	solatec produ uous de	l singularities, meromorp ct theorem and theorem	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 lear	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	<b>s</b> (type	, number of weekly conta	ict hours, language –	· if other than Germa	ın)
V (4) +	Ü (2)				
		sessment (type, scope, la ion on whether module c			tion offered — if not every seme-
Assess may on	ment w nly be s verview	elected as the subject of	topics in pure mathe one examination in t		on with the examiner. Each topic
themat		ssessment: German and	- ,		tik (Supplementary Topics in Ma-
themat	ige of a	ssessment: German and	- ,		
themat Langua	ige of a		- ,		
themat Langua Allocat	ige of a ion of J	olaces	- ,		
themat Langua Allocat	ige of a ion of J		- ,		
themat Langua Allocat  Additio 	ion of ponal inf	olaces	- ,		
themat Langua Allocat  Additio  Worklo	ion of ponal inf	olaces	- ,		
themat Langua Allocat  Additio  Worklo 390 h	ion of ponal inf	ormation	- ,		
themat Langua Allocat  Additio  Worklo	ion of ponal inf	ormation	- ,		
themat Langua Allocat  Additio  Worklo 390 h Teachin 	ion of ponal info	ormation e	/or English	Ergänzung Mathema	tik (Supplementary Topics in Ma-
themat Langua Allocat  Additio  Worklo 390 h Teachin 	ion of ponal info	ormation	/or English	Ergänzung Mathema	tik (Supplementary Topics in Ma-
themat Langua Allocat  Worklo 390 h Teachin  Referre	ion of ponal info onal info onal cycl	ormation e LPOI (examination regu	/or English	Ergänzung Mathema	tik (Supplementary Topics in Ma-
themat Langua Allocat  Additio  390 h Teachin  Referre  Module	ige of a ion of p onal inf onal inf onal inf oad ed to in e appea	ormation e LPOI (examination regu	/or English	Ergänzung Mathema	tik (Supplementary Topics in Ma-
themat Langua Allocat  Additio  390 h Teachin  Referre  Bachel	age of a ion of p onal inf pad ng cycl ed to in e appea or's de	ormation e LPOI (examination regu ars in gree (1 major) Mathemati	/or English	Ergänzung Mathema	tik (Supplementary Topics in Ma-
themat Langua Allocat  Additio  390 h Teachin  Referre Bachel Bachel	age of a ion of p onal inf bad ed to in e appea or's de or's de	ormation e LPOI (examination regu	/or English	Ergänzung Mathema	tik (Supplementary Topics in Ma-

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	Metho	od of grading	Only after succ. com	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	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	an)
V (4) +					
		<b>sessment</b> (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 of Studies Mathematik (Mathematics)				Institute of Mathen	natics
ECTS Method of grading Only after succ. compl. c				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	<b>s</b> (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 <b>Allocat</b>	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 Methe tik (Supplementary Topics in Ma
Auditio	onal inf	ormation			
		ormation			
 Worklo		ormation			
 <b>Worklo</b> 300 h	oad				
 <b>Worklo</b> 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	ts				
rems, i	solated		hic functions and La	urent series, residue	grals and Cauchy integral theo- theorem and applications, Wei-
Intend	ed lear	ning outcomes			
differe	ntial eq		o relate these conce	ots with one another	analysis and the theory of partia r, and realises the advantages of
Course	<b>s</b> (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-
may or den (O <sup>r</sup> themat	ily be s verview ics). ige of a	elected as the subject of Mathematical Methods)	one examination in t or in module group E	he sub-field Gesamt	oon with the examiner. Each topic überblick Mathematische Metho tik (Supplementary Topics in Ma
Additio	nal inf	ormation			
	inut init				
Worklo	ad				
390 h					
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	lations for teaching-o	legree programmes)	
	e appea	•			
Module		ars in			
			cal Physics (2015)		
Bachel	or's de	<b>ars in</b> gree (1 major) Mathemati gree (1 major) Mathemati	,		
Bachel Bachel	or's de or's de	gree (1 major) Mathemati	cal Physics (2016)		

Module					Abbreviation
Overvi	ew Geo	metric Analysis and Diff	erential Geometry for	Mathematical Phy-	10-M-GADG-PÜ-152-m01
sics					
Modul	e coord	inator		Module offered by	·
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics
ECTS	Meth	od of grading	Only after succ. com	npl. of module(s)	
13	nume	rical grade		•	
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts	·			
cations tion, su	s in vec ubmani	tor analysis and topolog	y; curves in Euclidean particular) in Euclidea	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		concepts with one and		c analysis and differential geo- ne advantages of thinking across
Course	<b>s</b> (type	, number of weekly cont	act hours, language —	- if other than Germa	ın)
V (4) +	Ü (2)				
oral ex Assess may or den (O themat	aminat ment v Ily be s verviev cics).	elected as the subject o	ch (20 to 40 minutes) o topics in pure mathe f one examination in t s) or in module group B	matics as agreed up he sub-field Gesamt	on with the examiner. Each topio 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 -1				
Doform	d to in	<b>LPO I</b> (examination reg	ulations for toaching	dogroo programmes)	
Referre		LFUI (examination reg		uegree programmes)	
		•			
Modul					
		gree (1 major) Mathema	• -		
		gree (1 major) Mathema			
		gree (1 major) Mathema gree (1 major) Mathema			
Datiel	01 3 UB	Sice (I major) mathéllia	11 CULI 11 V SILS (2024)		

Module					Abbreviation
Overvi	ew Geo	metric Analysis and Com	plex Analysis for Ma	thematical Physics	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 suc			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 larities, 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 the
		, number of weekly conta	ict hours, language –	- if other than Germa	in)
V (4) +					
		<b>sessment</b> (type, scope, la on on whether module c			tion offered — if not every seme-
Assess may or den (O themat	ment w nly be s verview tics).	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 <b>j</b>	olaces			
Additio	onal inf	ormation			
Additic	onal inf				
Additio					
 <b>Worklo</b> 390 h		ormation			
 <b>Worklo</b> 390 h	ad	ormation			
 Worklo 390 h Teachi	oad ng cycl	ormation e	lations for teaching-c	legree programmes)	
 Worklo 390 h Teachi	oad ng cycl	ormation	lations for teaching-c	legree programmes)	
 Worklo 390 h Teachin  Referre	ng cycl ed to in	ormation e LPOI (examination regu	lations for teaching-c	legree programmes)	
 Worklo 390 h Teachin  Referre  Modulo	oad ng cycl ed to in e appea	ormation e LPOI (examination regu		legree programmes)	
 Worklo 390 h Teachin  Referre  Bachel	ng cycl ed to in e appea or's de	ormation e LPO I (examination regu ars in gree (1 major) Mathemat	ical Physics (2015)	legree programmes)	
 Worklo 390 h Teachii  Referre  Module Bachel Bachel	ng cycl ed to in e appea or's de or's de	ormation e LPOI (examination regu	ical Physics (2015) ical Physics (2016)	legree programmes)	

Modul	e title				Abbreviation
Overvi	ew Geo	metric Analysis and Or	dinary Differential Equ	ations for Mathe-	10-M-GAGD-PÜ-152-m01
matica	l Physi	cs			
Modul	e coord	linator		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 numerical grade					
Duratio	on	Module level	Other prerequisites		
1 seme		undergraduate			
Conten	ts		<u> </u>		
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	<b>s</b> (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 oon 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 Studie	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	ts				
		in analysis on manifolds tor analysis and topology		ulus of differential fo	orms, Stoke's theorem and appli-
Intende	ed learı	ning outcomes			
		acquainted with the fun ethods to practical probl		nd methods in geom	netric analysis. He/she is able to
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	ın)
V (4) +	Ü (2)				
ster, in a) writt b) oral c) oral	formati en exar examin examin ige of a	on 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 6) or	ition offered — if not every seme-
Allocat	ion of p	olaces			
Additio	onal info	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		urs in			
Bachel Bachel First sta Bachel	or's de or's de ate exa or's de	gree (1 major) Mathemati gree (1 major) Mathemati gree (1 major) Computati mination for the teaching gree (1 major) Mathemati gree (1 major) Mathemati	cal Physics (2015) onal Mathematics (20 degree Gymnasium cal Physics (2016)	-	

Geomo	e title				Abbreviation
Geometric Analysis for Mathematical Physics					10-M-GANP-152-m01
Module coordinator				Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathen	natics
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
10	o numerical grade				
Duratio	on	Module level	Other prerequisites	;	
1 semester 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 l	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 l	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 l	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 <b>cion of j</b>	elected as the subject of / Mathematical Methods) ssessment: German and bonus	one examination in t or in module group l	he sub-field Gesam	tüberblick Mathematische Metho
themat Langua credita Allocat	verview cics). age of a ble for <b>cion of j</b>	elected as the subject of / Mathematical Methods) ssessment: German and bonus <b>blaces</b>	one examination in t or in module group l	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 <b>blaces</b>	one examination in t or in module group l	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 <b>blaces</b>	one examination in t or in module group l	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 <b>places</b>	one examination in t or in module group l	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 <b>places</b>	one examination in t or in module group l	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 <b>places</b>	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

Module					Abbreviation
Overvie	ew Geo	metric Analysis and Part	ial Differential Equati	ions for Mathemati-	10-M-GAPA-PÜ-152-m01
cal Phy					
Module coordinator				Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
13	3 numerical grade				
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
applica unique	itions i ness th	n vector calculus and top	ology, examples of fi	rst order partial diffe	forms, Stoke's theorem and its prential equations, existence and e theorems, maximum principle
Intende	ed lear	ning outcomes			
al diffe	rential		le to relate these cond	cepts with one anoth	c analysis and the theory of parti ner, and realises the advantages
Course	<b>s</b> (type	, number of weekly conta	ict hours, language —	- if other than Germa	n)
V (4) +	Ü (2)				
ster, in oral exa Assess may on den (O themat	formati aminat ment w Ily be s verview ics).	ion on whether module ca 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 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	-				
Allocal		JIACES			
Additio	nat inf	ormation			
Worklo	ad				
390 h					
Teachi	ng cycl	e	-		
Referre	d to in	LPOI (examination regu	lations for teaching-o	degree programmes)	
Modula	e appea	ars in			
Module					
	or's de	gree (1 major) Mathemati	ical Physics (2015)		
Bachel		gree (1 major) Mathemati gree (1 major) Mathemati			
Bachel Bachel	or's de		ical Physics (2016)		

Modul	e title				Abbreviation	
Basic N	Notions	and Methods of Mathe	ematical Reasoning		10-M-GBM-152-mo1	
Modul	e coordi	nator		Module offered by	<u> </u>	
	Dean of Studies Mathematik (Mathematics)			Institute of Mathematics		
ECTS				latics		
2 (not) successfully completed						
Duratio	Duration Module level Other prerequisites					
1 seme	ester	undergraduate				
Conter	nts					
Introdu	uction to	the basic notions and	l proof techniques in m	athematics: approa	ch to sets, formal log	gic and maps.
		ing outcomes	<u> </u>			<u> </u>
The stu	udent ge	ets acquainted with the	e basic working techniq	ues which are prere	quisites for the furth	er courses in
		degree study program		if other then Correct		
		number of weekly con	tact hours, language –	· ii other than Germa	111)	
V (1) +			1			
			language — if other tha can be chosen to earn		ition offered — if not	every seme-
		5 pages) ssessment: German an	d/or English			
	tion of p					
	<u></u>					
Δdditic	onal info	ormation				
				ior to the beginning	of the lecture period	
Worklo						•
60 h						
	ing cycle	2				
	ing cycle	•				
Referre	ed to in l	LPOI (examination reg	gulations for teaching-o	legree programmes)		
§ 22	Nr. 1 h) Nr. 2 f)		<u> </u>			
Modul	e appea	rs in				
		gree (1 major) Mathema	atics (2015)			
	-	gree (1 major) Economa				
Bachel	lor's deg	gree (1 major) Mathema	atical Physics (2015)			
			itional Mathematics (20			
			ng degree Grundschule		)	
			ng degree Realschule N			
			ng degree Mittelschule	Mathematics (2015	)	
	-	gree (1 major) Mathema	-			
	-	gree (1 major) Economa mination for the teachi	athematics (2017) ng degree Mittelschule	Mathomatics (acco	(Drüfungsordnungs	vorsion
2015))	late exai			Mathematics (2020	r (Fiululigsoluliuligs	Version
	lor's deg	gree (1 major) Mathema	atical Physics (2020)			
	-	gree (1 major) Economa	•			
	-	gree (1 major) Economa				
Bachel	lor's deg	gree (1 major) Mathema	atical Data Science (20	22)		
exchar	nge prog	ram Mathematics (202	23)			
	s with 1 majo	or Mathematical Physics		generated 19-Apr-2025 • ex		page 41 / 119
(2016)			ta record Bachelo	r (180 ECTS) Mathematische	Physik - 2016	

## 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)

Module	e title				Abbreviation
Overvie	ew Ord	inary Differential Equa	ations and Partial Differe	ntial Equations for	10-M-GDPA-PÜ-152-m01
Mather	matica	Physics		-	
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathe	ematics)	Institute of Mathem	atics
ECTS	1	od of grading	Only after succ. com	pl. of module(s)	
13 numerical grade					
Duratio	on	Module level	Other prerequisites		
1 seme		undergraduate			
Conten	ts	<u> </u>	Į.		
ferentia differen equatio	al equantial economic of i	tions, matrix exponen juations and partial di nathematical physics,	tial series, linear differen fferential equations of fir	itial equations of hi st order, existence	tial values, systems of linear dif- gher order; examples of partial and uniqueness theorems, basic ple and Dirichlet problem.
		ning outcomes			
tial equ	uations		ate these concepts with o		y of ordinary and partial differen- alises the advantages of thinking
Course	<b>s</b> (type	, number of weekly co	ntact hours, language —	if other than Germa	n)
V (4) +	Ü (2)				
ster, in	format	ion on whether modul	e, language — if other tha e can be chosen to earn a each (20 to 40 minutes)		tion offered — if not every seme-
may on den (Ov themat	ily be s verviev ics).	elected as the subject	of one examination in th ds) or in module group E	e sub-field Gesamt	on with the examiner. Each topic überblick Mathematische Metho tik (Supplementary Topics in Ma-
Allocat	-				
Additio	nal inf	ormation			
Worklo	he				
	au				
390 h					
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination re	egulations for teaching-d	egree programmes)	
Module	e appea	ars in			
	or's de				
	or 5 uc	gree (1 major) Mathen	natical Physics (2015)		
Bachel		gree (1 major) Mathen gree (1 major) Mathen			
Bachel Bachel	or's de	gree (1 major) Mathen			

Module	e title			Abbreviation	
Selecte	ed Topics in History of Mathema	atics		10-M-GES-152-m01	
M			Mandala afferraditor		
Module coordinator			Module offered by		
	ean of Studies Mathematik (Mathematics) Institute of Mathematics				
ECTS	Method of grading	Only after succ. com	ipl. of module(s)		
5	(not) successfully completed				
Duratio		Other prerequisites			
1 seme	ster undergraduate				
Conten	ts				
the fun	cal and cultural development as damentals of mathematics, in p of mathematics in modern socie	oarticular in its relatio			
Intende	ed learning outcomes				
	on selected examples, the stud eories and their social relevanc ce.				
Course	<b>s</b> (type, number of weekly conta	act hours, language —	if other than Germa	in)	
V (2) +	Ü (2)				
Method	d of assessment (type, scope, la	anguage — if other tha	an German, examina	tion offered — if not e	every seme-
	formation on whether module c				
Langua Assess	ect work (15 to 25 hours) ge of assessment: German and ment offered: In the semester in		offered and in the su	ubsequent semester	
Allocat	ion of places				
Additio	nal information				
Worklo	ad				
150 h					
Teachir	ng cycle				
Poforro	ed to in LPO I (examination regu	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) Computati ate examination for the teaching		-		
	or's degree (1 major) Mathemat	,	mathematics (2015)		
	ate examination for the teaching	•	Mathematics (2010)		
	or's degree (1 major) Mathemat	,			
	or's degree (1 major) Mathemat	•	22)		
	ge program Mathematics (2023				
	ate examination for the teaching		Mathematics (2023)		
	or's degree (1 major) Mathemat	,	,		
Bacheloric	with 1 major Mathematical Physics	IMIT Mürzburg	generated 19-Apr-2025 • exa	am reg da	page 44 / 119
(2016)	man 2 major mathematicat (Hysits		r (180 ECTS) Mathematische	-	Puse 44 / 119



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

Module					Abbreviation
	Algebra				10-M-LNA1-152-m01
Module coordinator				Module offered by	
Dean o	f Studi	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	ster	undergraduate			
Conten	lts				
Basic r termina		and structures; vector sp	aces, linear maps, sy	stems of linear equa	ations; theory of matrices and de-
Intend	ed lear	ning outcomes			
ted wit	h the co	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	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
V (4) +	Ü (2)				
		<b>essment</b> (type, scope, la on on whether module ca			tion offered — if not every seme-
exercis Langua	es eacl ige of a	n) ssessment: German and,		n exercises (approx.	12 exercise sheets with approx. 4
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
Worklo	ad				
240 h					
Teachi	ng cycl	e			
	3 3, 51	-			
Referre	d to in	LPOI (examination regu	lations for teaching of	legree programmec)	
Referre					
 Module	e appea	urs in			
		gree (1 major) Mathemati	-		
		gree (1 major) Economath			
		gree (1 major) Mathemati		<b>`</b>	
		gree (1 major) Computatio	-	015)	
		gree (1 major) Mathemati	,		
		gree (1 major) Economath			
		gree (1 major) Economath			
		gram Mathematics (2023)			
Dachel		gree (1 major) Mathemati	(2023)		

Module				-	Abbreviation
Overvie	ew Line	ar Algebra for Mathem	atical Physics		10-M-LNP-Ü-152-m01
Module	e coord	inator		Module offered by	1
Dean o	f Studi	es Mathematik (Mather	natics)	Institute of Mathen	natics
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
12	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
	inants;	eigenvalue theory; bili			equations; theory of matrices and paces; diagonalisability and Jor-
Intende	ed lear	ning outcomes			
knows them a	about I dequat	heir algebraic and geor rely in written and oral f	netric background, is a orm.	able to relate them t	s and methods of linear algebra, o each other and can present
		, number of weekly con	tact hours, language –	- if other than Germa	an)
V (4) +					
		sessment (type, scope, ion on whether module			ation offered — if not every seme-
Assess	ment w	ion of one candidate ea vill have reference to the ssessment: German an	e contents of modules	10-M-LNA-1 and 10-1	M-LNP-Ü.
Allocat	ion of <sub>l</sub>	olaces			
Additio	nal inf	ormation			
Worklo	ad				
360 h					
Teachi	ng cycl	e			
	_ ,				
Referre	d to in	LPOI (examination reg	ulations for teaching-	degree programmes	
Module	e appea	ars in			
Dathet	01 5 40	gree (1 major) Mathema	itical Physics (2015)		

Mather	e title			Abbreviation		
	matical Writing			10-M-MSC-152-m01		
	e coordinator		Module offered by			
	an of Studies Mathematik (Mathematics) Institute of Mathematics					
ECTS						
5	(not) successfully completed        uration     Module level     Other prerequisites					
Duratio						
1 seme	ster undergraduate					
Conten	ts					
vers the compre	sion of good and bad mathen e whole range of mathematic ehensive works such as Bach and efficiency but also didact	al texts from short proo elor's or Master's these	fs and the formulation	on of theorems and d	efinitions to	
Intende	ed learning outcomes					
	Ident is able to formulate mat he structures and conventior					
Course	<b>s</b> (type, number of weekly co	ntact hours, language –	- if other than Germa	n)		
V (2) +	Ü (2)					
	d of assessment (type, scope	, language — if other th	an German, examina	tion offered — if not	every seme-	
	formation on whether module				,	
Assess	ge of assessment: German a ment offered: In the semeste ion of places		offered and in the su	ibsequent semester		
	onal information					
Worklo	ad					
150 h						
	ng cycle					
Referre	ed to in LPO I (examination re	egulations for teaching-	legree programmes)			
<u> </u>						
§ 22						
Module	e appears in					
<b>Module</b> Bachele	or's degree (1 major) Mathem					
<b>Module</b> Bachele Bachele	or's degree (1 major) Mathem or's degree (1 major) Mathem	atical Physics (2015)				
<b>Module</b> Bachele Bachele Bachele	or's degree (1 major) Mathem or's degree (1 major) Mathem or's degree (1 major) Comput	atical Physics (2015) ational Mathematics (20	-			
Module Bachele Bachele First sta	or's degree (1 major) Mathem or's degree (1 major) Mathem or's degree (1 major) Comput ate examination for the teach	atical Physics (2015) ational Mathematics (20 ing degree Gymnasium	-			
Module Bachele Bachele First sta Bachele	or's degree (1 major) Mathem or's degree (1 major) Mathem or's degree (1 major) Comput ate examination for the teach or's degree (1 major) Mathem	atical Physics (2015) ational Mathematics (20 ing degree Gymnasium atical Physics (2016)	Mathematics (2015)			
Module Bachele Bachele First sta Bachele First sta	or's degree (1 major) Mathem or's degree (1 major) Mathem or's degree (1 major) Comput ate examination for the teach or's degree (1 major) Mathem ate examination for the teach	atical Physics (2015) ational Mathematics (20 ing degree Gymnasium atical Physics (2016) ing degree Gymnasium	Mathematics (2015)			
Module Bachele Bachele First sta Bachele First sta Bachele	or's degree (1 major) Mathem or's degree (1 major) Mathem or's degree (1 major) Comput ate examination for the teach or's degree (1 major) Mathem ate examination for the teach or's degree (1 major) Mathem	atical Physics (2015) ational Mathematics (20 ing degree Gymnasium atical Physics (2016) ing degree Gymnasium atical Physics (2020)	Mathematics (2015) Mathematics (2019)			
Module Bachele Bachele First sta Bachele First sta Bachele Bachele	or's degree (1 major) Mathem or's degree (1 major) Mathem or's degree (1 major) Comput ate examination for the teach or's degree (1 major) Mathem ate examination for the teach or's degree (1 major) Mathem or's degree (1 major) Mathem	atical Physics (2015) ational Mathematics (20 ing degree Gymnasium atical Physics (2016) ing degree Gymnasium atical Physics (2020) atical Data Science (20	Mathematics (2015) Mathematics (2019)			
Module Bachele Bachele First sta Bachele First sta Bachele Bachele exchan First sta	or's degree (1 major) Mathem or's degree (1 major) Mathem or's degree (1 major) Comput ate examination for the teach or's degree (1 major) Mathem ate examination for the teach or's degree (1 major) Mathem	atical Physics (2015) ational Mathematics (20 ing degree Gymnasium atical Physics (2016) ing degree Gymnasium atical Physics (2020) atical Data Science (20 23) ing degree Gymnasium	Mathematics (2015) Mathematics (2019) 22)			



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

	e 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		
		<b>sessment</b> (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 <b>ion of j</b>	nation of one candidate e lation in groups (groups o ssessment: German and bonus <b>blaces</b>	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 <b>ion of j</b>	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 <b>blaces</b>	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 <b>blaces</b>	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 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)	
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)	

Bachelor's with 1 major Mathematical Physics	
(2016)	

Modul	e title				Abbreviation
Numer	ical Ma	thematics 1 for Mathem	atical Physics		10-M-NUM1P-152-m01
Modul	e coord	inator		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 <sub>l</sub>	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	•		

	e title			-	Abbreviation
Numerical Mathematics 2 for Mathematical Physics					10-M-NUM2P-152-m01
Module	e coord	linator		Module offered by	
Dean o	f Studi	es Mathematik (Mather	matics)	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	i	
1 seme	ster	undergraduate			
Conten	Its				
		oblems, linear program ue problems.	ming, methods for init	ial value problems f	or ordinary differential equation
Intend	ed lear	ning outcomes			
about t and en	their ac gineeri	lvantages and limitatio ing sciences and econo	ns concerning the poss mics.	sibilities of application	nerical mathematics and knows fon in different fields of natural
		, number of weekly con	itact hours, language –	- if other than Germ	an)
V (4) +	Ü (2)				
		<b>sessment</b> (type, scope, ion on whether module			ation offered — if not every seme
b) oral c) oral Langua	examiı examir	mination (approx. 90 to nation of one candidate			
cieuild	age of a ble for	assessment: German an	s of 2, 10 to 15 minutes Id/or English		
	ble for	assessment: German an bonus			
	ble for	assessment: German an bonus			
Allocat 	ble for	assessment: German an bonus			
Allocat 	ble for	assessment: German an bonus <b>places</b>			
Allocat 	ble for ion of onal inf	assessment: German an bonus <b>places</b>			
Allocat  Additio 	ble for ion of onal inf	assessment: German an bonus <b>places</b>			
Allocat  Additio  Worklo 300 h	ble for ion of onal inf	assessment: German an bonus places formation			
Allocat  Additio  Worklo	ble for ion of onal inf	assessment: German an bonus places formation			
Allocat  Additio  Worklo 300 h Teachin	ble for ion of onal inf oad	assessment: German an bonus places formation	nd/or English	per candidate)	
Allocat  Additio  Worklo 300 h Teachin	ble for ion of onal inf oad	assessment: German an bonus places formation	nd/or English	per candidate)	)
Allocat  Additio  300 h Teachin  Referre	ble for ion of onal inf oad ng cycl	assessment: German an bonus places formation	nd/or English	per candidate)	)
Allocat  Additio  Worklo 300 h Teachin  Referre  Module	ble for ion of onal inf oad ng cycl ed to in	assessment: German an bonus places formation le LPO I (examination reg	gulations for teaching-	per candidate)	)
Allocat  Additio  Worklo 300 h Teachin  Referre  Bachel	ble for ion of onal inf oad ng cycl ed to in e appea or's de	assessment: German an bonus places formation le LPO I (examination reg ars in gree (1 major) Mathema	gulations for teaching-o	per candidate)	)
Allocat  Additio  Worklo 300 h Teachin  Referre Bachel Bachel Bachel	ble for ion of onal inf oad ed to in e appea or's de or's de	assessment: German an bonus places formation le LPO I (examination reg	gulations for teaching- atical Physics (2015) atical Physics (2016)	per candidate)	)

Module					Abbreviation
Operat	ions Re	esearch for Mathematica	l Physics		10-M-ORSP-152-m01
Module coordinator Module offered by					l
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	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				
Linear	program	nming, duality theory, tra	ansport problems, int	egral linear program	ming, graph theoretic problems.
Intend	ed lear	ning outcomes			
for solv	ving ma		pecially in economic		h, as required as a central tool apply these methods to practical
Course	<b>s</b> (type	, number of weekly conta	ict 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 Assess credita	examir examin ge of a ment o ble for		ach (15 to 30 minute of 2, 10 to 15 minutes /or English	5) or per candidate)	ubsequent semester
Allocat	ion of <sub>l</sub>	olaces			
 Additio	nal inf	ormation			
Worklo	ad		-		
300 h					
Teachi	ng cycl	e			
Referre	d to in	LPOI (examination regu	lations for teaching-	legree programmes)	
Module	e appea	ars in			
		gree (1 major) Mathemati	,		
		gree (1 major) Mathemati			
Bachel	or's de	gree (1 major) Mathemati	ical Physics (2020)		

Module title					Abbreviation	
Introdu	Introduction to Partial Differential Equations				10-M-PAR-152-m01	
Module		lunter.		Madula offered by	Madula offered by	
				Module offered by		
		es Mathematik (Mathema	-	Institute of Mathem	iatics	
ECTS		od of grading successfully completed	Only after succ. com	ipl. of module(s)		
9	<u> </u>					
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				
					c	
		is able to apply these me			neory of partial differential equa-	
		, number of weekly conta	· · · ·		n)	
		, number of weekly conta	ict nours, tanguage –	- II OLIIEI LIIAII GEIIIIA	11)	
V (4) +	· · · · ·					
		s <b>essment</b> (type, scope, la 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		
b) oral	examin	ation of one candidate e	ach (15 to 30 minutes	s) or		
		ation in groups (groups o		per candidate)		
		ssessment: German and, ffered: In the semester in		offered and in the cu	ibcoquent comector	
credita			i willen the course is	onereu anu în the st	ibsequent semester	
Allocat						
Additio	nal inf	ormation				
Worklo	ad					
270 h						
Teachi	ng cycl	e				
Referre	d to in	LPOI (examination regu	lations for teaching-o	legree programmes)		
Module	e appea	ins in				
Bachel	or's de	gree (1 major) Mathemati	cs (2015)			
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2015)			
		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
Module coordinator				Module offered 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	<b>s</b> (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 <b>ion of j</b>	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 <b>ion of j</b>	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 <b>blaces</b>	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 <b>blaces</b>	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 <b>blaces</b>	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 <b>blaces</b> 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	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 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 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
Introdu	uction	to Projective Geomet	ry for Mathematical Phys	sics	10-M-PGEP-152-m01
Module coordinator				Module offered by	
Dean o	of Studi	es Mathematik (Math	nematics)	Institute of Mather	natics
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)	
10	nume	erical grade			
Duratio	on	Module level	Other prerequisites	5	
1 seme	ester	undergraduate			
Conten	nts				
			ctive and affine spaces, t ities of projective spaces		es, fundamental theorems for pro
Intend	ed lear	ning outcomes			
		s acquainted with the nethods to practical p		and methods of proj	ective geometry. He/she is able to
Course	es (type	e, number of weekly c	ontact hours, language –	– if other than Germ	an)
V (4) +					
c) oral Langua Assess	examir age of a sment o	nation in groups (grou assessment: German	ate each (15 to 30 minute ups of 2, 10 to 15 minutes and/or English	-	
Allocat		bonus	ter in which the course is	offered and in the s	ubsequent semester
Allocat	tion of	bonus	ter in which the course is	offered and in the s	ubsequent semester
Allocat	tion of	bonus <b>places</b>	ter in which the course is	offered and in the s	ubsequent semester
Allocat	tion of onal inf	bonus <b>places</b>	ter in which the course is	offered and in the s	ubsequent semester
Allocat  Additic  Worklo	tion of onal inf	bonus <b>places</b>	ter in which the course is	offered and in the s	ubsequent semester
Allocat  Additic  Worklo 300 h	tion of onal inf oad	bonus places formation	ter in which the course is	offered and in the s	ubsequent semester
Allocat  Additic  Worklo	tion of onal inf oad	bonus places formation	ter in which the course is	offered and in the s	ubsequent semester
Allocat  Additio  Worklo 300 h Teachi	tion of onal inf oad ng cycl	bonus places formation le			
Allocat  Additio  Worklo 300 h Teachi  Referre	tion of onal inf oad ng cycl	bonus places formation le	regulations for teaching-		
Allocat  Additio  Worklo 300 h Teachi  Referre	tion of onal inf oad ng cycl ed to in	bonus places formation le LPO I (examination			
Allocat  Additic  Worklo 300 h Teachi  Referre  Modulo	tion of onal inf oad ing cycl ed to in	bonus places formation le LPO I (examination ars in	regulations for teaching-		
Allocat  Additio  Worklo 300 h Teachi Teachi Referre  Bachel	tion of onal inf oad ing cycl ed to in e appe	bonus places formation le LPO I (examination ars in egree (1 major) Mathe	regulations for teaching-		
Allocat  Additio  Worklo 300 h Teachi  Referre Bachel Bachel	tion of onal inf oad ng cycl ed to in e appe lor's de lor's de	bonus places formation le LPO I (examination ars in gree (1 major) Mathe gree (1 major) Mathe	regulations for teaching-		

Module	title			Abbreviation	
Prograi	mming course for students of	Mathematics and othe	er subjects	10-M-PRG-152-m01	
	e coordinator		Module offered by		
	f Studies Mathematik (Mather		Institute of Mathem	natics	
ECTS	Method of grading	Only after succ. con	npl. of module(s)		
3	(not) successfully completed				
Duratio		Other prerequisites			
1 seme	ster undergraduate				
Conten	ts				
Basics	of a modern programming lan	guage (e. g. C).			
Intende	ed learning outcomes				
	dent is able to work independ	ently on small program	nming exercises and	standard programm	ing problems
	nematics.			Standard programm	
Course	<b>s</b> (type, number of weekly con	tact hours language -	- if other than Germa	an)	
P (2)			n other than ochie	,	
	<b>1</b> - <b>C</b> + (h	; <b>C</b> ; <b>C</b>			
	<b>d of assessment</b> (type, scope, formation on whether module			ition offered — if not	every seme-
-			•		
	in the form of programming eage of assessment: German an		25 hours)		
	ment offered: Once a year, su				
	ion of places				
Allocat					
Additio	nal information				
Worklo	ad				
90 h					
Teachir	ng cycle				
Roforro	ed to in LPO I (examination reg	ulations for teaching.	legree programmes		
§ 22					
_					
	e appears in				
	or's degree (1 major) Mathema				
	or's degree (1 major) Physics (	-	<b>`</b>		
	or's degree (1 major) Nanostru		5)		
	or's degree (1 major) Economa	_			
	or's degree (1 major) Mathema		<b>`</b>		
	or's degree (1 major) Computa		015)		
	or's degree (1 major) Function		Mathematic		
	ate examination for the teachi		mathematics (2015)		
	or's degree (1 major) Mathema	-			
	or's degree (1 major) Economa		Mathomatics (acco)		
	ate examination for the teachi or's degree (1 major) Physics (		mainematics (2019)		
	or's degree (1 major) Physics ( or's degree (1 major) Nanostru		0)		
	or's degree (1 major) Mathema		0)		
	or's degree (1 major) Function	•			
	or's degree (1 major) Quantum				
	with 1 major Mathematical Physics		generated 19-Apr-2025 • ex	am. reg. da-	page 57 / 119
(2016)		-	r (180 ECTS) Mathematische	-	F-3- 5/ /9

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	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	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 <i>)</i>	
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				
Referre	d to in	LPOI (examination regu	lations for teaching-c	iegree programmes)		
		•				
Module						
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	Mathe	matics from a Higher Pe	rspective		10-M-SCH-152-m01	
Module coordinator				Module offered by	<u> </u>	
		es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	1	od of grading	Only after succ. con			
5		successfully completed		,		
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	its					
		selected topics in schoo implementation at both s			ation into wider theories and	
Intend	ed lear	ning outcomes				
	vanced	I mathematical theories.			between school mathematics athematical, didactical and me-	
		, number of weekly conta	act hours, language –	· if other than Germa	an)	
V (2) +	Ü (2)					
		<b>sessment</b> (type, scope, la ion on whether module c			tion offered — if not every seme	
	ment o	ssessment: German and ffered: In the semester ir <b>places</b>		offered and in the si	ubsequent semester	
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination regu	llations for teaching-o	legree programmes)		
§ 22    § 22    § 22	Nr. 2 f)					
Module		ars in				
		gree (1 major) Mathemat	ics (2015)			
			-			
Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Computational Mathematics (2015)						
	First state examination for the teaching degree Grundschule Mathematics (2015)					
First sta					)	
First sta First sta	ate exa	mination for the teaching	g degree Realschule N	Nathematics (2015)		
First sta First sta First sta	ate exa ate exa	mination for the teaching mination for the teaching	g degree Realschule A g degree Gymnasium	Aathematics (2015) Mathematics (2015)		
First sta First sta First sta First sta	ate exa ate exa ate exa	mination for the teaching mination for the teaching mination for the teaching	g degree Realschule A g degree Gymnasium g degree Mittelschule	Aathematics (2015) Mathematics (2015)		
First sta First sta First sta First sta Bachel	ate exa ate exa ate exa or's de	mination for the teaching mination for the teaching	g degree Realschule A g degree Gymnasium g degree Mittelschule ical Physics (2016)	Aathematics (2015) Mathematics (2015) 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)

Module title Abbreviation							
Supplementary Seminar Mathematics 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	bic in mathematics.					
		ning outcomes					
of a giv	en top				sters elaboration and structuring /She is able to participate active-		
Course	<b>s</b> (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 <sub>l</sub>	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					
		gree (1 major) Mathemati	cs (2015)				
		gree (1 major) Mathemati					
Bachel	or's de	gree (1 major) Computati	onal Mathematics (20	015)			
		gree (1 major) Mathemati	-				
Bachel	or's de	gree (1 major) Mathemati	cal 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					10-M-STO1P-152-m01
Module coordinator				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	<b>s</b> (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)				
	achelor's degree (1 major) Mathematical Physics (2020) achelor's degree (1 major) Mathematical Physics (2024)				

Module					Abbreviation
Stocha	stics 2	for Mathematical Phys	ics		10-M-STO2P-152-m01
Module coordinator Module offered by					<u> </u>
Dean o	f Studi	es Mathematik (Mather	natics)	Institute of Mathen	natics
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites	5	
1 seme	ster	undergraduate			
Conten	ts				
Elemer	nts of d	ata analysis, statistics o	of data in normal and o	other distributions, e	elements of multivariate statistics
Intend	ed lear	ning outcomes			
		acquainted with funda and knows about the t			s, applies these methods to prac-
Course	<b>s</b> (type	, number of weekly con	tact hours, language –	– if other than Germa	an)
V (4) +		· · ·	_ · · · ·		
b) oral c) oral Langua credita Allocat  Additic	examir examir age of a ble for ion of p		each (15 to 30 minute of 2, 10 to 15 minutes	s) or	
Worklo	ad				
300 h					
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination reg	gulations for teaching-	degree programmes	)
Module	e appea	ars in			
		gree (1 major) Mathema	• -		
		gree (1 major) Mathema	-		
		gree (1 major) Mathema			
Bachel	or's de	gree (1 major) Mathema	atical Physics (2024)		

Module t		Abbreviation					
Introduction to Topology 10-M-TOP-152-mo1							
Module	coordinator		Module offered by				
Dean of S	ean of Studies Mathematik (Mathematics)		Institute of Mathem	natics			
5 (not) successfully completed							
Duration		Other prerequisites					
1 semester undergraduate							
Contents	Contents						
les and c compact	constructions of topological sp	aces, quotients, con	vergence of sequenc	properties, connectivity, examp- es and nets, different notions of aß, Arzela-Ascoli and Baire, and			
Intended	l learning outcomes						
is able to		gebra and analysis to		as the pertinent proof methods, ses the broad applicability of the			
Courses	(type, number of weekly conta	ict hours, language –	- if other than Germa	in)			
V (2) + Ü	(2)						
ster, info a) writter b) oral ex c) oral ex	<ul> <li>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)</li> <li>a) written examination (approx. 90 to 180 minutes, usually chosen) or</li> <li>b) oral examination of one candidate each (15 to 30 minutes) or</li> <li>c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)</li> </ul>						
Assessm	e of assessment: German and, nent offered: In the semester ir le for bonus		offered and in the su	ubsequent semester			
Allocatio	on of places						
Addition	al information						
Workloa	d						
150 h							
Teaching	z cvcle						
	- ,						
Referred	to in IPO I (examination room	lations for teaching	legree programmee				
Keleffed	Referred to in LPO I (examination regulations for teaching-degree programmes)						
	Module appears in						
	r's degree (1 major) Mathemati r's degree (1 major) Mathemati	-					
	r's degree (1 major) Kathemati		015)				
	r's degree (1 major) Mathemati		<i></i>				
	r's degree (1 major) Mathemati	•					
	r's degree (1 major) Mathemati	-					
Bachelor	Bachelor's degree (1 major) Mathematical Physics (2024)						

Module	title			Abbreviation			
Exercise tutor or proof-reading in Mathematics				10-M-TuKo-152-mo:	1		
Modulo	coordinator		Module offered by				
		·····					
	f Studies Mathematik (Mather						
ECTS							
Duratio		Other prerequisites					
1 semes							
Conten							
	g or grading homework for on ervision of the respective lect			eaching degree prog	grammes un-		
Intende	ed learning outcomes						
	dent is able to support the ac	guisition of mathemati	cal skills and knowle	edge. He/She helps	to identify		
	es in mathematical proof exer				to racinty		
	<b>s</b> (type, number of weekly con	· · ·		n)			
T (0)				,			
	l of assessment (type, scope,	languaga if other th	an Carman, avamina	tion offered if not	0.000.0000		
	formation on whether module				every seme-		
Assessi	ment of tutoring activities or c	orrecting work by supe	ervising lecturers or e	exercise supervisors	(1 to 2 tea-		
ching u	nits or approx. 5 pieces of cor	recting work)					
Allocati	ion of places						
Additio	nal information						
Please	direct application to teaching	coordinator Mathemat	ics, he/she will sele	ct participants.			
Worklo							
150 h							
Teachir	ng cycle						
Referre	d to in LPO I (examination reg	gulations for teaching-	degree programmes)				
§ 22    N			<u> </u>				
	appears in						
	or's degree (1 major) Mathema	otics (2015)					
	or's degree (1 major) Kathema or's degree (1 major) Economa						
	or's degree (1 major) Economa or's degree (1 major) Mathema	_					
	or's degree (1 major) Computa	• -	015)				
	ate examination for the teachi						
	or's degree (1 major) Mathema	,					
	or's degree (1 major) Economa	•					
	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)							
	or's degree (1 major) Mathema		22)				
	ge program Mathematics (202	-	Mathomatics (asca)				
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)							
(2016)		-	r (180 ECTS) Mathematische	-	page 66 / 119		



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-m01							
Module coordinator				Module offered by			
Dean o	Dean of Studies Mathematik (Mathema		atics)	Institute of Mathem	atics		
ECTS	Method of grading Only after succ. compl. of module(s)						
7	7 numerical grade						
Duration Module level		Other prerequisites					
1 seme	ster	undergraduate					
Conter	Contents						
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	-				
		gree (1 major) Computatio		015)			
Bachelor's degree (1 major) Mathematical Physics (2016)							
1	Master's degree (1 major) Physics (2016)						
	-	ee (1 major) Nanostructur					
	-	ee (1 major) Nanostructur					
	-	ee (1 major) Physics (202					
	-	ee (1 major) Physics Inter					
	Master's degree (1 major) Quantum Engineering (2020) Master's degree (1 major) Quantum Technology (2021)						
1							
Dachel	Bachelor's degree (1 major) Mathematics (2023)						

	e title				Abbreviation
E-Learning and Blended Learning Mathematics 1					10-M-VHB1-152-m01
Modul	<u></u>	instor		Madula affarad by	
Module coordinator			Module offered by		
	n of Studies Mathematik (Mathematics) Institute of Mathematics		natics		
ECTS		od of grading	Only after succ. con	npl. of module(s)	
2		successfully completed			
Duration 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)	
 <b>Modul</b> Bachel	<b>e appe</b> a lor's de	<b>ars in</b> gree (1 major) Mathemat	ics (2015)	degree programmes)	
 <b>Modul</b> Bachel Bachel	<b>e appea</b> lor's de lor's de	<b>ars in</b> gree (1 major) Mathemat gree (1 major) Economatl	ics (2015) hematics (2015)	degree programmes)	
 <b>Modul</b> Bachel Bachel Bachel	<b>e appea</b> lor's de lor's de lor's de	<b>ars in</b> gree (1 major) Mathemat gree (1 major) Economatl gree (1 major) Mathemat	ics (2015) hematics (2015) ical Physics (2015)		•
 <b>Modul</b> e Bachel Bachel Bachel Bachel	<b>e appe</b> a lor's de lor's de lor's de lor's de	<b>ars in</b> 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		)
 <b>Modul</b> Bachel Bachel Bachel Bachel Bachel	<b>e appe</b> 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)		•
 <b>Modul</b> Bachel Bachel Bachel Bachel Bachel Bachel	<b>e appe</b> 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)		
 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) 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)		
 <b>Modul</b> 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)	
 <b>Modul</b> 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	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 (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 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	e title				Abbreviation	
E-Learning and Blended Learning Mathematics 2					10-M-VHB2-152-m01	
Modul	o coord	inator		Module offered by		
<b>Module coordinator</b> Dean of Studies Mathematik (Mathema		-+:)				
			-	Institute of Mathem	latics	
<b>ECTS</b> 2		od of grading successfully completed	Only after succ. con	ipt. of module(s)		
		, ,				
DurationModule level1 semesterundergraduate		Other prerequisites				
		undergraduate	<u> </u>			
Conter			· · · · ·			
		niliar with and reflecting t	echniques in e-learni	ing and blended lear	rning in mathematics.	
		ning outcomes				
The stu	udent is	able to employ advance	d methods of e-learn	ing and blended lea	rning in mathematics-	
Course	<b>es</b> (type	, number of weekly conta	ict hours, language —	- if other than Germa	in)	
Ü (2)						
Course	type: e	Learning, mostly Virtuell	e Hochschule Bayern	(vhb)		
					tion offered — if not every seme-	
ster, in	Iformati	ion on whether module c	an be chosen to earn	a bonus)		
		based, 15 to 20 hours)				
Assess	sment o	ffered: Once a year, sum	mer semester			
Allocat	tion of p	olaces				
Additio	onal inf	ormation				
Worklo						
60 h						
	ng cycl	0	-			
Teacili	ing cycl	e				
Referre	ed to in	LPOI (examination regu	llations for teaching-o	degree programmes)		
Modul	e appea	ars in				
		gree (1 major) Mathemati				
		gree (1 major) Economatl				
		gree (1 major) Mathemati				
		gree (1 major) Computati		015)		
		gree (1 major) Mathemati				
		gree (1 major) Economath				
		gree (1 major) Mathemati				
	Bachelor's degree (1 major) Economathematics (2021)					
Bachelor's degree (1 major) Economathematics (2022) Bachelor's degree (1 major) Mathematical Data Science (2022)						
		gree (1 major) Mathemati gram Mathematics (2023		<i>∠∠)</i>		
		gree (1 major) Mathemati				
		gree (1 major) Mathemati gree (1 major) Economati	-			
		gree (1 major) Economati gree (1 major) Mathemati				
		gree (1 major) Kathemati gree (1 major) Economati	•			
		gree (1 major) Economati	-			
- 401101						

Modul				_	Abbreviation
Introdu	uction	o Number Theory for Ma	thematical Physics		10-M-ZTHP-152-m01
Module coordinator				Module offered by	
Dean o	of Studi	es Mathematik (Mathem	atics)	Institute of Mathematics	
ECTS		od of grading	Only after succ. con	npl. of module(s)	
10	numerical grade				
		Other prerequisites	i		
1 seme	ster	undergraduate			
Conter	nts				
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			
		s acquainted with the fur methods and proof tech			ber theory. He/she is able to em-
Course	<b>s</b> (type	, number of weekly conta	act hours, language –	- if other than Germa	an)
V (4) +	Ü (2)				
		<b>sessment</b> (type, scope, la ion on whether module c			tion offered — if not every seme-
c) oral	examir age of a	nation of one candidate e nation in groups (groups issessment: German and bonus	of 2, 10 to 15 minutes	-	
Allocat	tion of	places			
Additio	onal inf	armation.			
		ormation			
 Worklo	ad	ormation			
 <b>Worklo</b> 300 h	oad				
300 h					
300 h <b>Teachi</b> 	ng cycl		lations for teaching-o	degree programmes)	
300 h <b>Teachi</b> 	ng cycl	e	lations for teaching-o	degree programmes)	
300 h <b>Teachi</b> 	ng cycl ed to in	e LPOI (examination regu	lations for teaching-o	degree programmes)	
300 h Teachi  Referre  Module	ng cycl ed to in e appea	e LPOI (examination regu		degree programmes)	
300 h Teachi  Referre  Module Bachel Bachel	ng cycl ed to in e appea or's de or's de	e LPO I (examination regu ars in gree (1 major) Mathemat gree (1 major) Mathemat	ical Physics (2015) ical Physics (2016)	degree programmes)	
300 h Teachi  Referre  Module Bachel Bachel Bachel	ng cycl ed to in e appea or's de or's de or's de	e LPO I (examination regu ars in gree (1 major) Mathemat	ical Physics (2015) ical Physics (2016) ical Physics (2020)	degree programmes)	

Module title					Abbreviation		
Astrop	Astrophysics 11-AP-152-mo1						
Module	Module coordinator			Module offered by	Module offered by		
Managing Director of the Institute of Theoretical Physics and Astrophysics				Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. compl. of module(s)				
6	numerical grade						
Duration Module level Other prerequisites							
1 seme	1 semester undergraduate						
Conten	ts						
telesco um, mo	pes an plecula	onomy, coordinates and d detectors, stellar stru r clouds, structure of the arge-scale structures, c	cture and atmosphere e milky way, the local	s, stellar evolution a	nd end stages, inter	stellar medi-	
Intend	ed lear	ning outcomes					
physica	al obse	are familiar with the mo rvations and evaluation familiar with the physic	s. They are able to use	e these methods to p	lan and analyse owr	n observati-	
Course	<b>s</b> (type	, number of weekly con	tact hours, language –	- if other than Germa	ın)		
V (2) + Module		t in: German or English					
	<b>Method of assessment</b> (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)						
b) oral c) oral d) proje e) pres If a writ stead t of asse	<ul> <li>a) written examination (approx. 90 to 120 minutes) or</li> <li>b) oral examination of one candidate each (approx. 30 minutes) or</li> <li>c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or</li> <li>d) project report (approx. 8 to 10 pages) or</li> <li>e) presentation/talk (approx. 30 minutes)</li> <li>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.</li> </ul>						
Allocat		-	<u>,                                     </u>				
Additio	onal inf	ormation					
Worklo	ad						
180 h							
Teaching cycle							
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)							
§ 22    Nr. 1 h)							
§ 22 II Nr. 2 f)							
§ 22    Nr. 3 f)							
Module appears in Bachelor's degree (1 major) Physics (2015)							
						,	
Bachelor's (2016)	with 1 ma	jor Mathematical Physics	-	• generated 19-Apr-2025 • exa or (180 ECTS) Mathematische	-	page 72 / 119	

# 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
	t Topic	s in Mathematical Phys	sics		11-BXMP5-152-m01
Modul	e coord	inator		Module offered by	<u> </u>
		f examination committe	ee Mathematische	Faculty of Physics	and Astronomy
•		ematical Physics)			
ECTS	1	od of grading	Only after succ. cor	mpl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites	5	
1 seme	ester	undergraduate	Approval from exan	nination committee i	required.
Conten	nts				
	t topics ly abroa		cs. Accredited academ	nic achievements, e.	g. in case of change of university
Intend	ed lear	ning outcomes			
sics of unders	the Ba stand th	chelor's programme. Th	ey have knowledge of methods necessary to	a current subdiscipl	of a module of Mathematical Phy ine of Mathematical Physics and edge. They are able to classify the
Course	<b>es</b> (type	, number of weekly con	tact hours, language -	– if other than Germa	an)
V (2) +	R (2)				
		sessment (type, scope, ion on whether module			ation offered — if not every seme-
pages) If a wri	) or pres itten ex take the	sentation/talk (approx. amination was chosen form of an oral examin	30 minutes). as method of assessm	ent, this may be cha	or project report (approx. 8 to 10 Inged and assessment may in-
of asse nation	date at	the latest.	er must inform studen		
of asse nation Langua	date at	the latest. ssessment: German ar	er must inform studen		
of asse nation Langua	date at age of a	the latest. ssessment: German ar	er must inform studen		
of assention Langua Allocat	date at age of a <b>tion of</b> [	the latest. ssessment: German ar	er must inform studen		
of assention Langua Allocat	date at age of a <b>tion of</b> [	the latest. ssessment: German ar <b>blaces</b>	er must inform studen		amination in groups. If the method weeks prior to the original exami
of assention Langua Allocat	date at age of a tion of onal inf	the latest. ssessment: German ar <b>blaces</b>	er must inform studen		
of asse nation Langua Allocat  Additic  Worklo	date at age of a tion of onal inf	the latest. ssessment: German ar <b>blaces</b>	er must inform studen		
of asse nation Langua Allocat  Additic  Worklo 150 h	date at age of a tion of onal inf	the latest. ssessment: German ar <b>blaces</b> ormation	er must inform studen		
of asse nation Langua Allocat  Additic  Worklo 150 h	date at age of a tion of onal inf	the latest. ssessment: German ar <b>blaces</b> ormation	er must inform studen		
of asse nation Langua Allocat  Additic  150 h Teachi 	date at age of a tion of onal inf oad	the latest. ssessment: German ar places ormation	er must inform studen	ts about this by four	weeks prior to the original exami
of asse nation Langua Allocat  Additic  150 h Teachi 	date at age of a tion of onal inf oad	the latest. ssessment: German ar <b>blaces</b> ormation	er must inform studen	ts about this by four	weeks prior to the original exami
of asse nation Langua Allocat  Additio  150 h Teachi  Referre 	date at age of a tion of onal inf oad ing cycl ed to in	the latest. ssessment: German ar places ormation e LPO I (examination re	er must inform studen	ts about this by four	weeks prior to the original exami
of asse nation Langua Allocat  Additic  Yorklo 150 h Teachi  Referre  Modulo	date at age of a tion of p onal inf oad ing cycl ed to in e appea	the latest. ssessment: German ar places ormation e LPO I (examination report ars in	er must inform studen Id/or English	ts about this by four	weeks prior to the original exami
of asse nation Langua Allocat  Additic  Worklo 150 h Teachi  Referre  Bachel	date at age of a tion of p onal inf oad ing cycl ed to in e appea lor's de	the latest. ssessment: German ar olaces ormation e LPO I (examination report ars in gree (1 major) Mathema	er must inform studen Id/or English gulations for teaching-	ts about this by four	weeks prior to the original exam
of asse nation Langua Allocat  Additio  150 h Teachi  Referre  Bachel Bachel	date at age of a tion of onal inf oad ing cycl ed to in e appea lor's de lor's de	the latest. ssessment: German ar places ormation e LPO I (examination report ars in	er must inform studen Id/or English 	ts about this by four	weeks prior to the original examination of the origination

Modul					Abbreviation	
Curren	t Topic	s in Mathematical Phys	sics		11-BXMP6-152-m01	
Modul	e coord	inator		Module offered by	<u> </u>	
		f examination committe	e Mathematische	Faculty of Physics a	and Astronomy	
•		ematical Physics)			and Astronomy	
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	undergraduate	Approval from exan	nination committee r	equired.	
Conter	nts					
	t topics ly abroa		cs. Accredited academ	nic achievements, e.	g. in case of change of university	
Intend	ed lear	ning outcomes				
unders subjec	tand th	ne numeric and analytic fic contexts and know t	methods necessary to he application areas.	acquire this knowle	ine of Mathematical Physics and edge. They are able to classify the	
		, number of weekly con	tact hours, language -	– If other than Germa	an)	
V (3) +						
		<b>sessment</b> (type, scope, ion on whether module			ation offered — if not every seme	
pages) If a wri stead t of asse nation	or pres tten ex take the essmen date at	sentation/talk (approx. amination was chosen e form of an oral examir	30 minutes). as method of assessm nation of one candidat er must inform studen	ent, this may be cha e each or an oral exa	or project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the metho weeks prior to the original exam	
	tion of					
Additio	onal inf	ormation				
Worklo	bad					
180 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination reg	gulations for teaching-	degree programmes		
					)	
					)	
 Module	e appea	ars in			)	
	<b>e appe</b> a lor's de		atical Physics (2015)		)	
Bachel	lor's de	<b>ars in</b> gree (1 major) Mathema gree (1 major) Mathema			)	
Bachel Bachel	lor's de lor's de	gree (1 major) Mathema	atical Physics (2016)		<u>,                                     </u>	

Module					Abbreviation	
Curren	t Topic	s in Mathematical Phy	/sics		11-BXMP8-152-m01	
Module	e coord	inator		Module offered by		
		f examination commit	tee Mathematische	Faculty of Physics		
•		ematical Physics)		ruculty of rifysics		
ECTS	Meth	od of grading	Only after succ. co	mpl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisite	S		
1 seme	ster	undergraduate	Approval from exar	nination committee	required.	
Conten	Its					
Current or stud			sics. Accredited acaden	nic achievements, e.	g. in case of change of university	
Intend	ed lear	ning outcomes				
unders subjec	tand th t-speci	e numeric and analyt fic contexts and know	ic 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	
V (4) +		- (				
			e, language — if other th e can be chosen to ear		ation offered — if not every seme	
pages) If a writ stead t of asse nation	or pres tten exa ake the essmen date at	sentation/talk (approx amination was choser form of an oral exam	k. 30 minutes). n as method of assessm ination of one candidat urer must inform studen	nent, this may be cha e each or an oral exa	or project report (approx. 8 to 10 anged and assessment may in- amination in groups. If the metho r weeks prior to the original exam	
Allocat						
Additio	onal inf	ormation				
Worklo	ad					
240 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination r	egulations for teaching	degree programmes	)	
Module	e appea	ars in				
		gree (1 major) Mathen	natical Physics (2015)			
Duchet		giee (I majoi) mathem	natical Physics (2016)			

Module					Abbreviation	
		al Physics			11-CP-152-m01	
Module	e coord	inator		Module offered by	· · · · · · · · · · · · · · · · · · ·	
Managi and As	-	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS		od of grading	Only after succ. cor	npl. of module(s)		
6	nume	rical grade				
Duratio		Module level	Other prerequisites	5		
1 seme	-	undergraduate				
Conten						
• n • s • g • ra	iumerio imulat generat andom	ction to programming o cal solution of different ion of chaotic systems ion of random numbers walk article processes and re	ial equations			
Intende	ed lear	ning outcomes				
They ha	ave kno	have knowledge of two owledge of numerical si ysical problems, e.g. a	tandard methods and a	are able to apply com	puter-assisted proc	
Course	<b>s</b> (type	, number of weekly con	itact hours, language –	– if other than Germa	ın)	
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 earn	ı a bonus)		
<ul> <li>b) oral</li> <li>c) oral of</li> <li>d) projection</li> <li>If a write stead to</li> <li>of assemblication</li> <li>Langua</li> </ul>	examir examin ect repo tten exa ake the essmen date at age of a	mination (approx. 90 to nation of one candidate nation in groups (group) ort (approx. 8 to 10 pag amination was chosen to form of an oral examin t is changed, the lectur the latest. Issessment: German ar iffered: 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 nd/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	ion of <sub>l</sub>	places				
Additio	onal inf	ormation				
Worklo	ad					
180 h						
Teachi	ng cycl	e				
	_					
Referre	ed to in	LPOI (examination reg	gulations for teaching-	degree programmes)		
Module	e appea	ars in				
		gree (1 major) Physics ( gree (1 major) Mathema	-			
·		jor Mathematical Physics	JMU Würzburg	• generated 19-Apr-2025 • exa or (180 ECTS) Mathematische		page 77 / 119

#### 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	e title				Abbreviation		
Classic	al Phys	sics 2 (Heat and Electro	omagnetism)		11-E-E-152-m01		
Module	e coord	inator		Modulo offered by	offered by		
		-	Analiad Direct	Module offered by			
-		ector of the Institute of		Faculty of Physics a	and Astronomy		
ECTS		od of grading	Only after succ. con	npl. of module(s)			
8		rical grade					
	Duration         Module level           1 semester         undergraduate		Other prerequisites			,	
1 semester		undergraduate			completion of exerci		
			-	-	nts who successfully	•	
					admission to assess		
				students about the r	espective details at t	he beginning	
			of the semester.				
Conten	nts						
1. Ther	modyna	amics (linked to 11-E-M	); temperature and qua	ntity of heat, thermo	ometer, Kelvin scale;		
2. Heat	t condu	ction, heat transfer, di	ffusion, convection, rac	liant heat;			
			lynamics, entropy, irrev		demon;		
•	-		efficiency, example: Sti	5 5			
5. Real gases and liquids, states of matter (also solids), van der Waals, critical point, phase transitions, critical phenomena (opalescence), coexistence region, Joule-Thomson;							
			ctrical charge, forces; e		eld concept field lin	es field of a	
point c			etheat enalge, forces, t				
•	•	entence, related to Cou	lomb's law, definition	of "river"; Gaussian s	surface, divergence t	heorem; spe	
	cial symmetries; divergence and GS in differential form;						
	8. Electrical potential, working in the E-box, electric. potential, potential difference, voltage; potential equation,						
equipotential surfaces; several important examples: Sphere, hollow sphere, capacitor plates, electric dipole; lace effects, Segner wheel;							
			omogeneous field, Mill	ikan experiment Bra	aun tube: electron: F	ield emissi.	
			omogeneous and inhor				
			on, capacity; plate and				
dia in t	he cap	acitor; electrical polari	sation, displacement a	nd orientation polari	sation, microscopic	image; diel-	
	•		acitor; Piezoelectric eff				
			ensity, drift velocity, co				
			stivity, temperature de	pendence; Ohm's la	w; realisations (resis	tive and non-	
	NTC, P		nhoff's rules (meshes, i	nodes), internal resi	stance of a voltage s	ource mea.	
-		ients; Wheatstone brid		ioucs), internaticsi.		ource, mea	
-			apacitor charge; galva	nic element; thermo	voltage;		
15. Trai	nsfer m	echanisms, conduction	n in solids: Band mode	l, semiconductor; lin	e in liquids and gase	es;	
	-		s; permanent magnet,		initions and units; E	arth's ma-	
-			to e-box, magn. river,			1	
-			n, analogous to electric	scalar potential; ca	lculation of fields, ex	kamples,	
	oltz coi ving ch		etic field, current balar	nce. Lorentz force rig	ht-hand rule electri	c motor di-	
			pectrometer, Wien filter				
•			cts of the field on matte				
ferroma	agnetis	m; magn. moment of t	ne electron, behaviour	at interfaces;			
			tion, Lenz's rule, flux c		field, Waltenhofen's	s pendulum;	
			ons: Transformer, gener		work Manualla -	noine	
		displacement current, well equations;	choice of integration a	ea, displacement cl	ment; maxwell's ext	ension, wave	
		-	orations, amplitude, pe	riod and phase now	ver and RMS value	hmic resi-	
			or, capacitor and coil, p				
		tance; performance of					
-							
Bachelor's (2016)	with 1 ma	jor Mathematical Physics	-	generated 19-Apr-2025 • exa r (180 ECTS) Mathematische	-	page 81 / 119	
(2010)				(100 LC10) Mathematistile	11y51K 2010		

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

--

## 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 19-Apr-2025 • exam. reg. da-	page 82 / 119
(2016)	ta record Bachelor (180 ECTS) Mathematische Physik - 2016	

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	e title				Abbreviation
Introdu	uction t	o Solid State Physics			11-E-F-152-m01
Module	e coord	inator		Module offered by	
Manag	Managing Director of the Institute of A		oplied Physics	Faculty of Physics a	and Astronomy
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
8	nume	rical grade			
Duration 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 strongl on 8. Supe	erfeld c n-Franz tal stru fects; p propert recipro Scatte cture d n diffra ce vibra ; quant les of d mal pro il expar trons in y boun	oefficient; electrons in fie z law; Hall effect; limitatio cture, periodic lattice; typ oolycrystals; amorphous s ies cal lattice (RG), motivatio ring; Ewald construction; etermination, probes: X-r action, LEED ations (phonons), equation tisation: Phonon moment lispersion curves (occ. Kr operties of insulators, Ein nasion; thermal conductivi a periodic potential, Blo d electrons (tight binding	elds: Drude-Lorentz-Sons of the model bes of lattices; Bravai solids; group theoreti n: Diffraction; Bragg Bragg equation; Lau ay, electron, neutron ons of motion; disper- tum; optical propertie amers-Kronig), measu stein and Debye moo ty; Umklapp process ch theorem; band str g, LCAO); examples of	sommerfeld; electrica is lattice; Miller indic cal approaches, the condition; definition e's equation; structu ; methods: Laue, Del sion; group velocity; es in the infrared; die urement methods del; phonon density es; crystal defects ructure; approximation f band structures, Fe	Termi-Dirac statistics; spec. heat, al and thermal conductivity, Wie- ces; simple crystal structures; lat- importance of symmetry for elec- a; Brillouin zones; diffraction ure and form factor bye-Scherrer, rotating crystal; diatomic base: optical, acoustic electric function (Lorentz model); of states; anharmonicity and on of nearly free electrons (NFE); rmi surfaces, spin-orbit interacti- odes, band structure, many-par-
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	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	in)
V (4) + Module	· · ·	t in: Ü: German or Englisł	1		
		<b>sessment</b> (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					Abbreviation	
Classic	al Phys	sics 1 (Mechanics)			11-E-M-152-m01	
Module				Module offered by		
		ector of the Institute of		Faculty of Physics	and Astronomy	
ECTS		od of grading	Only after succ. c	ompl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisit	es		
1 seme	ster	undergraduate	Admission prerec	uisite to assessment:	completion of exercises (approx.	
			13 exercise sheet	s per semester). Stude	ents who successfully completed	
			approx. 50% of ex	kercises will qualify fo	r admission to assessment. The	
			lecturer will inform	n students about the	respective details at the beginning	
			of the semester.			
Conten	ts					
			SI), importance of me		nalysis, time / length / mass (de-	
					Uniform and constant accelerated	
			r motion in polar coor			
					the pendulum, forces on an ato-	
mic sca	ale, isot	tropic and anisotropi	c friction. Preparation	of the equations of mo	otion and solutions;	
		nergy: (Kinetic) perfo				
-		•		d momentum conserva	ation, surges in centre of mass	
		ystem, rocket equation		• • • • • •		
6. Conservative and non-conservative force fields: Potential, potential energy; law, weight scale, field strength and potential of gravity (general relations);						
				torque rotational e	nergy, moment of inertia, analo-	
					r), escape velocities, trajectories	
-		potential;	5115) Saterines (3e65ra	lionary and merstella		
			erence systems, appare	ent forces, Foucault pe	endulum, Coriolis force, centrifu-	
gal forc						
					nelson interferometer, Einstein's	
•	ates, pr	oblem of simultaneit	y, Lorentz transformati	on, time dilation and	length contraction, relativistic im-	
pulse;	ما ام ما ر	and surran Data			ad allingaid univainal averaged	
					nd -ellipsoid, principal axes and e; gyroscope: Precession and nu-	
		th as a spinning top;		sol, physics of the bik	e; gyloscope: Fielession and nu-	
				rolling friction, visco	us friction, laminar flow, eddy for-	
mation			,		,,,,,,,	
		Representation by m	eans of complex e-fun	ction, equation of mot	ion (DGL) on forces, torque and	
					ılum, physical pendulum, dampeo	
			, aperiodic limit), force			
-	•	_	s and eigenfunctions,	double pendulum, dei	terministic vs. chaotic motion,	
		namics and chaos;	rea and languages at the	ouos polastastas	nainle of our supportion and a st	
					nciple of superposition, reflectior se and group velocity, dispersion	
relatior	•	ia ciusea ena, speed	or sound, intelletellet	, poppier enect; pilds	הי מוום בוסטף יפוטכוני, עוצףפוצוטוו	
		ormation of solid boo	lies: Elastic modulus,	general Hooke's law. e	elastic waves:	
					gle, capillary forces, steady flows,	
					essure, compressibility and com-	
pressiv						
					equipartition theorem, Brownian s of freedom, specific heat	
mation	collici	an avaaa aa tian waa				

### 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

--

### 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)

§ 53 | Nr. 1 a)

§ 77 | Nr. 1 a)

# Module appears in

Mouule appears in					
Bachelor's degree (1 major) Physics	(2015)				
Bachelor's degree (1 major) Nanostr	ucture Technology (2015)				
Bachelor's degree (1 major) Mathem	atical Physics (2015)				
Bachelor's degree (1 major, 1 minor)	Physics (Minor, 2015)				
First state examination for the teach	ing degree Grundschule Physics (2015)				
First state examination for the teach	ing degree Realschule Physics (2015)				
First state examination for the teach	ing degree Gymnasium Physics (2015)				
First state examination for the teach	ing degree Mittelschule Physics (2015)				
Bachelor's degree (1 major) Mathem	atical Physics (2016)				
First state examination for the teach	ing degree Grundschule Physics (2018)				
First state examination for the teach	ing degree Realschule Physics (2018)				
First state examination for the teach	ing degree Gymnasium Physics (2018)				
First state examination for the teach	ing 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)	Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)				
First state examination for the teach	ing degree Grundschule Physics (2020)				
First state examination for the teach	ing degree Gymnasium Physics (2020)				
First state examination for the teach	ing degree Realschule Physics (2020)				
Bachelor's with 1 major Mathematical Physics	JMU Würzburg • generated 19-Apr-2025 • exam. reg. da-	page 87 / 119			
(2016)	ta record Bachelor (180 ECTS) Mathematische Physik - 2016				

#### 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)

Module	title				Abbreviation
Optics	and Wa	aves			11-E-O-152-m01
Module	e coord	inator		Module offered by	
Managi	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy
ECTS		od of grading	Only after succ. con	npl. of module(s)	
8	nume	rical grade			
Duratio		Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
2. Light constant tion, bi 3. Geor tion, op thick le astigma 4. Optic am vs. 5. Wave profile) Mach-Z 6. Diffra ar-field 8. Failu ves (Da 10. Wave quantu 9. Failu ves (Da 10. Wave quantu 9. Failu ves (Da 11. Mat son to v lue equ gy quant (states, The stu stand t measur autono <b>Course</b> V (4) + Module	in mat in mat refringe metrica otical tu- nses, l atism, of cal inst image e optices , thin fi ender, action i Rayleis action i micros re of cl otoelec m struct re d learn dents u he theo ring me mously e taugh	ter: propagation velocity orption, Kramers-Kronig r ence, optical activity (dip l optics: basic concepts, unneling, evanescent wav ens systems, lens grinde coma, distortion, correcti ruments: characteristics; construction (electron ler s: spatial and temporal co ilms, parallel layers, wed Fabry-Perot). In the far field: Fraunhofe gh & Abbé criterion, Fouri olution, diffraction off atc n the near field: Fresnel, scopy, holography, Huyge assical physics I - from lig tric effect and Einstein's cture of nature assical physics II - particl -Germer-experiment, dou hanics: wave packets, ph n theorem, wave function echanics (double-slit exp cal concepts of quantum ptics, free particle and pa simple examples in 1D (p n, harmonic oscillator), b tors, observables). <b>ning outcomes</b> understand the basic prir pretical concepts and know ethods. They are able to a v apply their knowledge to a v apply their knowledge t	in the medium; disp relation, interfaces, Fi ole) Fermat's principle, of ves, prism; normal ar r formula, aberration on approaches). camera, eye, magnifi nses, electron micros oherence, Young's do ge-shaped layers, ph r diffraction, , single er optics, optical gra- omic lattices, convolu- near-field diffraction ens-Fresnel concept; ght wave to photon: I explanation, Compton les as waves: de Brog ble slit interference). hase and group veloci- as probability ampli- periment & which-way mechanics: Schrödin articles in a potential potential step, potent box potential in higher holpes and contexts by the structure and a pply mathematical m o the solution of mather is thours, language —	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 rir 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 ra- tude, probability of ra- y information, collap nger equation as wars, time-independent S- ial barrier and tunne er dimensions and de- of radiation, wave ar application of import hethods to the formu hematical-physical ta- if other than Germa	, interference pattern (intensity ngs, interferometer (Michelson, ution, apertures, resolving nsity distribution, grating spectro- disks, Fresnel zone plate, ne- and Planck's quantum hypothe- article, wave-particle duality, , oncept; diffraction of particle wa- uncertainty principle, Ny- residence, measurement process se of the wave function, Schrö- ve equation, conceptual compari- Schrödinger equation as eigenva- l effect, box potential and ener- egeneracy, formal theory of QM 
					tion offered — if not every seme-
		on on whether module ca		a DOIIUS)	
written	examii	nation (approx. 120 minu	tesj		

Bachelor's with 1 major Mathematical Physics	JMU Würzburg • generated 19-Apr-2025 • exam. reg. da-	page 89 / 119
(2016)	ta record Bachelor (180 ECTS) Mathematische Physik - 2016	

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	e title				Abbreviation	
	Nuclear and Elementary Particle Physics					
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy	
ECTS		od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 seme	ster	undergraduate				
Conten	ts					
2. Meth charge 3. Nucl 4. Strue 5. Radii 6. Nucl the che 7. Radii duction 8. Instr 9. Elect 10. Stro confine 11. Wea ce, exc 12. Sta	<ol> <li>Overview, historical introduction, history and significance of Nuclear and Particle Physics</li> <li>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</li> <li>Nuclear models, the mass of the atomic nuclei, droplet model, bonding energy, nuclear shell model</li> <li>Structure of cores, angular momentum, spin, parity, mag. and electr. moments, collective excitation forms, spin-orbit interaction</li> <li>Radioactivity and spectroscopy, radioactive decay, natural and civilisational sources of ionising radiation</li> <li>Nuclear energy, nuclear fission, nuclear reactors, nuclear fusion, star power, star development, formation of the chemical elements of hydrogen</li> <li>Radiation and matter, interaction of radiation and matter, Bethe-Bloch formula, photoelectric effect, pair production</li> <li>Instruments, accelerators and detectors</li> <li>Electromagnetic interaction, differential cross section, virtual photons, Feynman graphs, exchange interaction</li> <li>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</li> <li>Weak interaction, cracked mirror symmetries, Wu experiment, charge conjugation, time reversal, CP invariance, exchange particles, W and Z, neutrinos, neutrino vibrations</li> <li>Standard model, three families of leptons and quarks, quark-lepton symmetry, Higgs boson, free parameters</li> </ol>					
	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			
		<b>sessment</b> (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	e title				Abbreviation	
Group <sup>-</sup>	Theory				11-GRT-152-m01	
Module	e coord	inator		Module offered by		
	ing Dire	ector of the Institute of 1	heoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6		rical grade		• • • •		
Duratio	Ouration Module level Other prerequisites					
1 seme	ster	graduate				
Conten	ts					
Group t	theory.	Finite groups. Lie group	s. Lie algebra. Depicti	on. Tensors. Classifi	cation theorem. Appl	lications.
-		ning outcomes				
group t	heory a	know the basics of grou and to solve them by us cessing of physical prol	ing the acquired meth			
Course	<b>s</b> (type	, number of weekly cont	act hours, language –	- if other than Germa	n)	
V (2) + Module		t in: German or English				
		<b>sessment</b> (type, scope, ion on whether module			tion offered — if not	every seme-
d) proje e) pres If a writ stead t of asse nation Langua	ect repo entatio tten exa ake the essmen date at age of a	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 and	es) or Ites). Is method of assessm ation of one candidate er must inform student	ent, this may be char e each or an oral exa	nged and assessmer mination in groups. I	f the method
Allocat	ion of <sub>l</sub>	olaces				
			_			
Additio	nal inf	ormation	_			
Worklo	ad					
180 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
Module	e appea	ars in				
Bachel	or's de	gree (1 major) Physics (2	2015)			
		gree (1 major) Mathema	• –			
		gree (1 major) Mathema	•			
		gree (1 major) Physics (2				
		gree (1 major) Mathema	tical Physics (2020)			
		gram Physics (2023)				
		gree (1 major) Mathema				
Bachelor's (2016)	with 1 ma	jor Mathematical Physics	-	generated 19-Apr-2025 • exa r (180 ECTS) Mathematische	-	page 93 / 119

Module c         Managing and Astropartic participation         ECTS       M         6       (I)         Duration       I         2 semest       Contents         Principles       duction t         Intended       I         Y (2) + Ü       Module t         Method c       ster, info         a) exercis       b) talk (a         Allocatio	Method of grading         not) successfully completed         Module level         ter       undergraduate	Only after succ. cor  Other prerequisites  alculation methods b ules of Theoretical Ph inciples of mathema cal Physics. ct hours, language – nguage – if other th an be chosen to earn	Module offered by Faculty of Physics and Astro npl. of module(s) Faculty of Physics and Astro npl. of module(s) Faculty of Physics and Astro npl. of module(s) Faculty of Physics and Astro Second Second Sec	n, especially for the intro- imental Physics. ion methods which are
Managing and Astro ECTS A 6 (1) Duration 2 semest Contents Principles duction t Intended The stude required Courses V (2) + Ü Module t Method c ster, info a) exercis b) talk (a Allocationa 	g Director of the Institute of The physics  Method of grading not) successfully completed  Module level undergraduate s of mathematics and basic cate o and preparation of the module learning outcomes ents have knowledge of the pr in Theoretical and Experiment (type, number of weekly contate (1) + V (2) + Ü (1) aught in: German or English of assessment (type, scope, la rmation on whether module cate ses (successful completion of pprox. 15 minutes) n of places	Only after succ. cor  Other prerequisites  alculation methods b ules of Theoretical Ph inciples of mathema cal Physics. ct hours, language – nguage – if other th an be chosen to earn	Faculty of Physics and Astro npl. of module(s) reyond the school curriculum hysics and Classical or Exper itics and elementary calculat – if other than German) an German, examination offer a bonus)	n, especially for the intro- imental Physics. ion methods which are
Managing and Astro ECTS A 6 (1) Duration 2 semest Contents Principles duction tr Intended The stude required Courses (1) V (2) + Ü Module tr Method c ster, info a) exercis b) talk (a Allocationa 	g Director of the Institute of The physics  Method of grading not) successfully completed  Module level undergraduate s of mathematics and basic cate o and preparation of the module learning outcomes ents have knowledge of the pr in Theoretical and Experiment (type, number of weekly contate (1) + V (2) + Ü (1) aught in: German or English of assessment (type, scope, la rmation on whether module cate ses (successful completion of pprox. 15 minutes) n of places	Only after succ. cor  Other prerequisites  alculation methods b ules of Theoretical Ph inciples of mathema cal Physics. ct hours, language – nguage – if other th an be chosen to earn	Faculty of Physics and Astro npl. of module(s) reyond the school curriculum hysics and Classical or Exper itics and elementary calculat – if other than German) an German, examination offer a bonus)	n, especially for the intro- imental Physics. ion methods which are
and Astro ECTS A 6 (1) Duration 2 semest Contents Principles duction tr Intended The stude required Courses V (2) + Ü Module tr Method c ster, info a) exercis b) talk (a Allocationa 	Method of grading         not) successfully completed         Module level         ter       undergraduate         s of mathematics and basic car         o and preparation of the modu         learning outcomes         ents have knowledge of the pr         in Theoretical and Experiment         (type, number of weekly contar         (1) + V (2) + Ü (1)         aught in: German or English         of assessment (type, scope, larmation on whether module car         ses (successful completion of pprox. 15 minutes)         n of places	Only after succ. cor  Other prerequisites  alculation methods b ules of Theoretical Ph inciples of mathema cal Physics. ct hours, language – nguage – if other th an be chosen to earn	npl. of module(s) s beyond the school curriculum hysics and Classical or Exper atics and elementary calculat - if other than German) an German, examination offer a bonus)	n, especially for the intro- imental Physics. ion methods which are
6 (i <b>Duration</b> 2 semest <b>Contents</b> Principles duction tr <b>Intended</b> The stude required <b>Courses</b> (i) V (2) + Ü Module tr <b>Method c</b> ster, info a) exercis b) talk (a <b>Allocatio</b>  <b>Additiona</b>	not) successfully completed Module level ter undergraduate s of mathematics and basic car o and preparation of the module learning outcomes ents have knowledge of the pr in Theoretical and Experiment (type, number of weekly contar (1) + V (2) + Ü (1) aught in: German or English of assessment (type, scope, lar rmation on whether module car ses (successful completion of pprox. 15 minutes) on of places	 Other prerequisites  alculation methods b ules of Theoretical Ph inciples of mathema cal Physics. ct hours, language – nguage – if other th an be chosen to earn	eeyond the school curriculum nysics and Classical or Exper itics and elementary calculat – if other than German) an German, examination offe a bonus)	imental Physics. ion methods which are
Duration 2 semest Contents Principles duction tr Intended The stude required Courses V (2) + Ü Module tr Method c ster, info a) exercis b) talk (a Allocatio  Additiona	Module level         ter       undergraduate         s of mathematics and basic cars         ents have knowledge of the print         in Theoretical and Experiment         (type, number of weekly contars         (1) + V (2) + Ü (1)         aught in: German or English         of assessment (type, scope, larmation on whether module carses (successful completion of pprox. 15 minutes)         or of places	Other prerequisites	eyond the school curriculum hysics and Classical or Exper itics and elementary calculat – if other than German) an German, examination offo a bonus)	imental Physics. ion methods which are
2 semest Contents Principles duction to Intended The stude required Courses V (2) + Ü Module to Method co ster, info a) exercis b) talk (a Allocatio  Additiona	ter undergraduate s of mathematics and basic ca o and preparation of the modu learning outcomes ents have knowledge of the pr in Theoretical and Experiment (type, number of weekly conta (1) + V (2) + Ü (1) aught in: German or English of assessment (type, scope, la rmation on whether module ca ses (successful completion of pprox. 15 minutes) on of places	 alculation methods b ules of Theoretical Ph inciples of mathema al Physics. ct hours, language – nguage — if other th an be chosen to earn	eyond the school curriculum hysics and Classical or Exper itics and elementary calculat – if other than German) an German, examination offo a bonus)	imental Physics. ion methods which are
Contents Principles duction to Intended The stude required Courses V (2) + Ü Module to Ster, info a) exercis b) talk (a Allocatio  Additiona	s of mathematics and basic ca o and preparation of the module learning outcomes ents have knowledge of the pr in Theoretical and Experiment (type, number of weekly conta (1) + V (2) + Ü (1) aught in: German or English of assessment (type, scope, la rmation on whether module ca ses (successful completion of pprox. 15 minutes) on of places	ules of Theoretical Ph inciples of mathema cal Physics. .ct hours, language – .nguage — if other th an be chosen to earn	nysics and Classical or Exper atics and elementary calculat – if other than German) an German, examination offe a bonus)	imental Physics. ion methods which are
Principles duction to Intended The stude required Courses V (2) + Ü Module to Method co ster, info a) exercis b) talk (a Allocatio  Additiona	s of mathematics and basic ca o and preparation of the modu learning outcomes ents have knowledge of the pr in Theoretical and Experiment (type, number of weekly conta (1) + V (2) + Ü (1) aught in: German or English of assessment (type, scope, la rmation on whether module ca ses (successful completion of pprox. 15 minutes) n of places	ules of Theoretical Ph inciples of mathema cal Physics. .ct hours, language – .nguage — if other th an be chosen to earn	nysics and Classical or Exper atics and elementary calculat – if other than German) an German, examination offe a bonus)	imental Physics. ion methods which are
duction t Intended The stude required Courses V (2) + Ü Module t Method c ster, info a) exercis b) talk (a Allocatio  Additiona	o and preparation of the modu <b>learning outcomes</b> ents have knowledge of the print in Theoretical and Experiment (type, number of weekly contain (1) + V (2) + Ü (1) aught in: German or English of assessment (type, scope, lain rmation on whether module can ses (successful completion of pprox. 15 minutes) on of places	ules of Theoretical Ph inciples of mathema cal Physics. .ct hours, language – .nguage — if other th an be chosen to earn	nysics and Classical or Exper atics and elementary calculat – if other than German) an German, examination offe a bonus)	imental Physics. ion methods which are
The stude required <b>Courses</b> V (2) + Ü Module tr <b>Method c</b> ster, info a) exercis b) talk (a <b>Allocatio</b>  <b>Additiona</b>	ents have knowledge of the pr in Theoretical and Experiment (type, number of weekly conta (1) + V (2) + Ü (1) aught in: German or English of assessment (type, scope, la rmation on whether module ca ses (successful completion of pprox. 15 minutes) n of places	al Physics. ct hours, language – nguage — if other th an be chosen to earn	– if other than German) an German, examination offe a bonus)	
required Courses V (2) + Ü Module t Method c ster, info a) exercis b) talk (a Allocatio  Additiona	in Theoretical and Experiment (type, number of weekly conta (1) + V (2) + Ü (1) aught in: German or English of assessment (type, scope, la rmation on whether module ca ses (successful completion of pprox. 15 minutes) n of places	al Physics. ct hours, language – nguage — if other th an be chosen to earn	– if other than German) an German, examination offe a bonus)	
V (2) + Ü Module ta Method c ster, info a) exercis b) talk (a Allocatio  Additiona	(1) + V (2) + Ü (1) aught in: German or English of assessment (type, scope, la rmation on whether module ca ses (successful completion of pprox. 15 minutes) n of places	nguage — if other th an be chosen to earn	an German, examination offe a bonus)	ered — if not every seme-
Module ta Method c ster, info a) exercis b) talk (a Allocatio  Additiona	aught in: German or English of assessment (type, scope, la rmation on whether module ca ses (successful completion of pprox. 15 minutes) n of places	an be chosen to earn	i a bonus)	ered — if not every seme-
Method of ster, info a) exercis b) talk (a Allocatio  Additiona	of assessment (type, scope, la rmation on whether module ca ses (successful completion of pprox. 15 minutes) n of places	an be chosen to earn	i a bonus)	ered — if not every seme-
ster, info a) exercis b) talk (a Allocatio  Additiona	rmation on whether module ca ses (successful completion of pprox. 15 minutes) <b>n of places</b>	an be chosen to earn	i a bonus)	ered — if not every seme-
b) talk (a Allocatio  Additiona 	pprox. 15 minutes) n of places	approx. 50% of appr	ox. 13 exercise sheets) or	
Allocatio  Additiona 	n of places			
 Additiona				
Additiona	al information			
	al information			
 Workload				
WORKIOAC				
	a			
180 h				
Teaching	ç cycle			
	to in LPO I (examination regu	lations for teaching-	degree programmes)	
§ 53   Nr.	-			
§ 77   Nr.	appears in			
	's degree (1 major) Physics (20	215)		
	's degree (1 major) Nanostruct		5)	
	's degree (1 major) Mathemati			
	's degree (1 major, 1 minor) Ph			
	e examination for the teaching	-	e Physics (2015)	
	e examination for the teaching	-		
	e examination for the teaching	-	-	
	e examination for the teaching			
	's degree (1 major) Mathemati	-		
First state	e examination for the teaching	g degree Grundschule	e Physics (2018)	
First state	e examination for the teaching	g degree Realschule I	Physics (2018)	
First state	e examination for the teaching	g degree Gymnasium	Physics (2018)	
First state	e examination for the teaching	g degree Mittelschule	e Physics (2018)	
Bachelor's wit 2016)		JMU Würzburg		

Module title				Abbreviation	
Data and Erro	or Analysis		_	11-P-FR1-152-m01	
Module coord	linator		Module offered by		
	rector of the Institute of A	Applied Physics	Faculty of Physics a	and Astronomy	
	od of grading	Only after succ. con	, ,	ind Astronomy	
2 (not) successfully completed					
Duration	Module level	Other prerequisites	j		
1 semester       undergraduate       Admission prerequisite to assessment: completion of exercises of 13 exercise sheets per semester). Students who successfully con approx. 50% of exercises will qualify for admission to assessment lecturer will inform students about the respective details at the boot of the semester.				y completed ssment. The	
Contents					
Types of error and standard	rs, error approximation a deviation.	and propagation, grapl	nic representations,	linear regression, m	ean values
Intended lear	rning outcomes				
	are able to evaluate me I to draw, present and di			gation and of the pri	nciples of
Courses (type	e, number of weekly con	tact hours, language –	- if other than Germa	ın)	
V (1) + Ü (1) Module taugł	nt in: Ü: German or Engli	sh			
<b>Method of assessment</b> (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)					
	ination (approx. 120 min assessment: German an				
Allocation of					
	•				
Additional in	formation				
this will be co 3 Sentence 4 find that the s gistration for ly register for sessment wa	If a student registers for onsidered a declaration ASPO (general academi student has obtained the assessment into effect. an assessment. Studen s not put into effect will which he/she has not be	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	on to assessment pu ulations). If the mod lission to assessmer nat meet the respect for an assessment of respective assessm	Irsuant to Section 2 ule coordinators su It, they will put the ive prerequisites ca or whose registratio ent. If a student tak	o Subsection bsequently student's re- n successful- n for an as- tes an as-
Workload					
60 h					
Teaching cyc	le				
Referred to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
§ 53   Nr. 1 c) § 77   Nr. 1 d)					
Module appe	ars in				
Bachelor's de	egree (1 major) Mathema egree (1 major) Physics (: egree (1 major) Nanostru	2015)	5)		
	ajor Mathematical Physics	IAIL M/Burkey a	generated 19-Apr-2025 • exa		

## 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	ed and	Computational Data Ana	alysis		11-P-FR2-152-m01	
Module	a coord	inator		Module offered by		
			aplied Dhysics	· · · ·	and Astronomy	
ECTS	-	ector of the Institute of Ap od of grading	Only after succ. con	Faculty of Physics a		
2		successfully completed	Unity after Succ. con			
Duration         Module level         Other prerequisites           1 semester         undergraduate         Students are highly recommended to complete module 11			mplata modulo 11 D EP1 prior to			
1 Seine	completing module 11-P-FR2.					
Conten	Its					
		thods of data analysis ar data analysis.	nd error calculation. D	Distribution function	, significance tests, modelling.	
Intend	ed lear	ning outcomes				
stered discuss	methoo s the re	ls of computerised data sults.	analysis are able to a	ipply them to self-ob	error calculation. They have ma- tained measuring data and to	
		, number of weekly conta	act hours, language –	- if other than Germa	an)	
V (1) +	Ü (1)		-			
		<b>essment</b> (type, scope, la on on whether module c			ation offered — if not every seme	
		cessful completion of ap ffered: Once a year, sum		. 10 exercise sheets)		
Allocat		· · · · ·				
Allocal		Jaces				
			-			
Additio	onal inf	ormation				
			-			
Worklo	ad					
60 h						
Teachi	ng cycl	е				
			_			
Referre	ed to in	LPO I (examination regu	llations for teaching-	degree programmes)		
Module	e appea	urs in				
		gree (1 major) Physics (20	015)			
		gree (1 major) Nanostruc		5)		
		gree (1 major) Mathemat				
		gree (1 major) Mathemat				
		gree (1 major) Physics (20				
		gree (1 major) Nanostruc		o)		
		gree (1 major) Mathemat				
Bachel	or's de	gree (1 major) Functional	Materials (2021)			
Bachel	or's de	gree (1 major) Quantum 1	Fechnology (2021)			
exchan	ige prog	gram Physics (2023)				
Bachel	or's de	gree (1 major) Mathemat	ical Physics (2024)			
Bachelor's degree (1 major) Mathematical Physics (2024) Bachelor's degree (1 major) Functional Materials (2025)						

Lahan	e title				Abbreviation
Laboratory Course Physics B for Students of Mathematica				Physics	11-P-MPB-152-m01
Module	e coord	inator		Module offered by	
Managi	ing Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	and Astronomy
ECTS		od of grading	Only after succ. con	npl. of module(s)	
4 (not) successfully completed					
Duratio	on	Module level	Other prerequisites		
		undergraduate			mplete modules 11-P-PA and 11-
P-FR1 prior to completing module 11-P-MPB.					PB.
Conten	lts		-		
Physica	al laws	of optics, vibrations and	waves, science of ele	ectricity and circuits	with electric components.
Intende	ed lear	ning outcomes			
measu princip	ring pro	otocol. They are able to e tatistics and to draw, pre	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
	<b>s</b> (type	, number of weekly conta	act hours, language –	- if other than Germa	in)
P (2)			_		
<b>Method of assessment</b> (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)					
practical assignment with talk (approx. 30 minutes) Preparing, performing and evaluating (record of readings or lab report) the experiments will be considered suc- cessfully completed if a Testat (exam) is passed. Exactly one experiment that was not successfully completed can be repeated once. After completion of all experiments, talk (with discussion; approx. 30 minutes) to test the candidate's understanding of the physics-related contents of the module. Talks that were not successfully com- pleted can be repeated once. Both components of the assessment have to be successfully completed.					
pleted	can be	nderstanding of the phys repeated once. Both con	sics-related contents	of the module. Talks	that were not successfully com-
	can be	nderstanding of the phys repeated once. Both con	sics-related contents	of the module. Talks	that were not successfully com-
pleted Allocat	can be i <b>on of j</b>	nderstanding of the phys repeated once. Both con <b>places</b>	sics-related contents	of the module. Talks	that were not successfully com-
pleted Allocat	can be i <b>on of j</b>	nderstanding of the phys repeated once. Both con	sics-related contents	of the module. Talks	that were not successfully com-
pleted Allocat  Additio 	can be ion of J onal inf	nderstanding of the phys repeated once. Both con <b>places</b>	sics-related contents	of the module. Talks	that were not successfully com-
pleted of Allocat  Additio  Worklo	can be ion of J onal inf	nderstanding of the phys repeated once. Both con <b>places</b>	sics-related contents	of the module. Talks	that were not successfully com-
pleted Allocat  Additio 	can be ion of J onal inf	nderstanding of the phys repeated once. Both con <b>places</b>	sics-related contents	of the module. Talks	that were not successfully com-
pleted Allocat  Additio  Worklo	can be ion of j onal inf	nderstanding of the phys repeated once. Both con places ormation	sics-related contents	of the module. Talks	that were not successfully com-
pleted Allocat  Additio  Worklo 120 h	can be ion of j onal inf	nderstanding of the phys repeated once. Both con places ormation	sics-related contents	of the module. Talks	that were not successfully com-
pleted of Allocat  Additio  120 h Teachin 	can be ion of p onal inf pad	nderstanding of the phys repeated once. Both con places ormation	sics-related contents nponents of the asse	of the module. Talks ssment have to be s	that were not successfully com- uccessfully completed.
pleted of Allocat  Additio  120 h Teachin 	can be ion of p onal inf pad	nderstanding of the phys repeated once. Both con places ormation	sics-related contents nponents of the asse	of the module. Talks ssment have to be s	that were not successfully com- uccessfully completed.
pleted of Allocat  Additio  120 h Teachin 	can be ion of p onal inf oad ng cycl	nderstanding of the phys repeated once. Both con places ormation e LPO I (examination regu	sics-related contents nponents of the asse	of the module. Talks ssment have to be s	that were not successfully com- uccessfully completed.
Pleted of Allocat  Additio  Worklo 120 h Teachin  Referre  Module	can be ion of p onal inf pad ng cycl ed to in	nderstanding of the phys repeated once. Both con places ormation e LPO I (examination regu	sics-related contents nponents of the asse	of the module. Talks ssment have to be s	that were not successfully com- uccessfully completed.
Allocat  Additio  Worklo 120 h Teachin  Referre Bachelo	can be ion of j onal inf pad ng cycl ed to in e appea or's de	nderstanding of the phys repeated once. Both con places ormation e LPO I (examination regu	ical Physics (2015)	of the module. Talks ssment have to be s	that were not successfully com- uccessfully completed.
pleted of Allocat Allocat	can be ion of j onal inf pad ng cycl ed to in e appea or's de or's de or's de	nderstanding of the phys repeated once. Both con places ormation e LPO I (examination regu ars in gree (1 major) Mathemat	ical Physics (2015) ical Physics (2016) ical Physics (2020)	of the module. Talks ssment have to be s	that were not successfully com- uccessfully completed.

Module title					Abbreviation
Labora	tory Co	urse 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 a	and Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
4	(not) s	successfully completed			
Duratio	on	Module level	Other prerequisites		
undergraduate Students are highly recommended to complete module 11-P-MPB pri completing module 11-P-MPC.					mplete module 11-P-MPB prior to
Conten	Its				
		of wave optics, Molecula sed devices with examp			rn measuring methods using spe-
Intend	ed learı	ning outcomes			
by usir and dis	ng error scuss tł		cs. They are able to e and a presentation.	valuate results, to d	raffic, and to analyse the results raw conclusions and to present
P (2)		,			,
practic Prepari cessful can be candid pleted	al assig ing, per lly com repeate ate's u	oleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both con	. 30 minutes) record of readings or is passed. Exactly on n of all experiments, ics-related contents	lab report) the expe e experiment that wa talk (with discussior 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.
Additio	onal info	ormation			
Worklo	ad				
120 h			-		
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	llations for teaching-o	degree programmes)	
Module	e appea	irs in			
		gree (1 major) Mathemat	ical Physics (2015)		
		gree (1 major) Mathemat			
		gree (1 major) Mathemat			
Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major) Mathematical Physics (2024)					

Module					Abbreviation
Labora	tory Cou	irse Physics A (Mechan	ics, Heat, Electromag	netism)	11-P-PA-152-m01
Module	e coordi	nator		Module offered	l by
			nuliad Dhusias	1	
ECTS	1	ctor of the Institute of A		· · ·	ics and Astronomy
	·	d of grading uccessfully completed	Only after succ. con	ipi. of module(s	)
3	<u> </u>				
Duratio		Module level	Other prerequisites		
1 seme	I	undergraduate			
Conten					
rents, h	heat cap		ity of bodies, dynami	c viscosity, elas	e.g. measurement of voltages and cu ticity, surface tension, spring con-
Intende	ed learni	ing outcomes			
le to in		ently plan and conduct			perimenting techniques. They are a s, and to document the results in a
Course	<b>s</b> (type,	number of weekly cont	act hours, language –	- if other than G	erman)
P (2)					
Method	d of asse	essment (type, scope, l	anguage — if other th	an German, exai	nination offered — if not every sem
		on on whether module of			,
pleted		epeated once. Both co			alks that were not successfully com be successfully completed.
Additio	onal info	rmation			
			_		
Worklo	ad				
90 h			_		
Teachi	ng cycle				
Referre	ed to in L	<b>POI</b> (examination reg	ulations for teaching-	degree program	nes)
Module	e appear	's in			
Bachel	or's deg	ree (1 major) Mathemat	ics (2015)		
	-	ree (1 major) Physics (2	-		
	-	ree (1 major) Nanostruc		5)	
	-	ree (1 major) Mathemat			
	-	ree (1 major) Computat		-	
	-	ree (1 major) Aerospace	•	2015)	
	-	ree (1 major) Mathemat	•	``	
	-	ree (1 major) Aerospace	•	2017)	
	-	ree (1 major) Physics (2			
Bachel	or's deg	ree (1 major) Nanostruc	ture rechnology (202	0)	
achelor's	with 1 majo	r Mathematical Physics	-	generated 19-Apr-202	
2016)			ta record Bachelo	r (180 ECTS) Mathemat	ische Physik - 2016

#### 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)

D	title				Abbreviation	
Preparat	tory Co	ourse Mathematics			11-P-VKM-152-m01	
					<b></b>	
Module	_			Module offered by		
		ctors of the Institute of Theoretical Physics an		Faculty of Physics a	nd Astronomy	
ECTS	Metho	d of grading	Only after succ. con	npl. of module(s)		
2 (	(not) s	uccessfully completed				
Duration	n [	Module level	Other prerequisites			
1 semest	ter	undergraduate				
Contents	s ,		-			
the intro 1. Basic ( 2. Coord 3. Vector 4. Differe 5. Integra Intendec The stud successf Courses T (2) Method a) exerci	ductic geome inate : rs - vec ential d al calc d learn lents k fully st (type, of ass ormatic ses (s		or the modules of Expe umbers nathematics and elem Experimental Physics fact 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
Allocatio	on of p					
Workloa	d					
60 h						
Teaching	a cuel					
reacting	5 LYLIE	-				
§ 22 II N	r. 1 h)	LPOI (examination reg	ulations for teaching-o	aegree programmes)		
§ 22    N	-					
§ 22    Ni § 22    Ni	r. 3 f)	rs in				
§ 22    N § 22    N § 22    N	r. 3 f) <b>appea</b>		2015)			
§ 22 II Ni § 22 II Ni Bachelor Bachelor Bachelor Bachelor First stat First stat	r. 3 f) appea r's deg r's deg r's deg r's deg te exar te exar te exar	gree (1 major) Physics (2 gree (1 major) Nanostru gree (1 major) Mathema gree (1 major, 1 minor) F mination for the teachir mination for the teachir mination for the teachir	cture Technology (201) tical 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)
§ 22 II Ni § 22 II Ni Bachelor Bachelor Bachelor First stat First stat First stat	r. 3 f) appea r's deg r's deg r's deg r's deg te exar te exar te exar te exar	gree (1 major) Physics (2 gree (1 major) Nanostru gree (1 major) Mathema gree (1 major, 1 minor) F mination for the teachin mination for the teachin	cture Technology (201 tical 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)

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					Abbreviation		
Theory	Theory of Relativity     11-RTTB-232-m01						
Module	coord	inator		Module offered by			
Managi and Ast	•	ector of the Institute of T sics	heoretical Physics	Faculty of Physics a	nd Astronomy		
		od of grading	Only after succ. con	npl. of module(s)			
6	6 numerical grade						
Duratio		Module level	Other prerequisites	i			
1 semes	ster	undergraduate					
Content	ts						
Differen Brief Su Element Electroc Field eq Stellar 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 Introduction to cosmology						
Familian of the fo and the	Intended learning outcomes Familiarity with the basic physical and mathematical concepts of general relativity. Mathematical understanding of the formulation in terms of differential forms. Understanding of the formal similarity between electrodynamics and the theory of general relativity, viewing both of them as gauge theories. Application of the theory to simple models of stellar equilibrium. First contact with elements of cosmology.						
Courses	s (type	, number of weekly cont	act hours, language –	- if other than Germa	n)		
V (3) + F							
		t in: German or English					
		<b>sessment</b> (type, scope, l on on whether module			tion offered — if not	every seme-	
b) oral e c) oral e d) proje e) prese If a writt stead ta of asses nation o Languag	examir examin ect repo entatio ten exa ake the ssmen date at ge of a	mination (approx. 90 to nation of one candidate ation in groups (groups ort (approx. 8 to 10 page n/talk (approx. 30 minu amination was chosen a e form of an oral examin t is changed, the lecture the latest. ssessment: German and ffered: In the semester i	each (approx. 30 minu of 2, approx. 30 minu es) or tes). s method of assessm ation of one candidate er must inform student	ites per candidate) o ent, this may be char e each or an oral exa ts about this by four	nged and assessmer mination in groups. weeks prior to the or	If the method iginal exami-	
Allocati	on of p	olaces					
Additio	nal inf	ormation					
		examination committee	e required				
Workloa			<u></u>				
180 h			_				
Teachin	g cycl	e					
	3	•					
Referro	d to in	LPO I (examination reg	ulations for teaching	degree programmes)			
Referre				actice programmes)			
 Bachelor's v (2016)	vith 1 maj	jor Mathematical Physics		• generated 19-Apr-2025 • exa or (180 ECTS) Mathematische		page 104 / 119	

# 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 Compu	ter Physics		11-SDC-152-m01	
Modul	e coord	inator		Module offered by		
Manag		ector of the Institute of	Applied Physics	Faculty of Physics a	and Astronomy	
ECTS	1	od of grading	Only after succ. co	mpl. of module(s)		
4	nume	rical grade				
Durati	Duration Module level Other prerequisites					
1 semester graduate						
Conter	nts					
Statist	ics. dat	a analysis and compute	er physics.			
		ning outcomes	<u> </u>			
		nave specific and adva		field of statistics da	ata analysis and Con	nutational
Physic					ata anatysis and Con	inputationat
Course	<b>es</b> (type	, number of weekly con	tact hours, language	— if other than Germa	ın)	
V (2) +	R (1)					
Modul	e taugh	t in: German or English				
		s <b>essment</b> (type, scope, on on whether module			ition offered — if not	every seme-
-						
		mination (approx. 90 to ation of one candidate		utes) or		
		ation in groups (groups		-	r	
		ort (approx. 8 to 10 pag				
		n/talk (approx. 30 min				
		mination was chosen a		ient, this may be cha	nged and assessme	nt may in-
		form of an oral examir				
ofasse	essmen	t is changed, the lectur	er must inform studer	its about this by four	weeks prior to the o	riginal exami-
		the latest.				
-	-	ssessment: German an				
		ffered: Once a year, wir	iter semester			
Alloca	tion of p	olaces				
Additio	onal inf	ormation				
Worklo	oad					
120 h						
-	ing cycl	e				
Referre	ed to in	LPOI (examination reg	gulations for teaching	-degree programmes)		
Modul	e appea	ins in				
Bache	lor's de	gree (1 major) Physics (	2015)			
Bache	lor's de	gree (1 major) Nanostru	cture Technology (20	15)		
Bache	lor's de	gree (1 major) Mathema	atical Physics (2015)			
Bache	lor's de	gree (1 major) Mathema	atical Physics (2016)			
Bache	lor's de	gree (1 major) Physics (	2020)			
Bache	lor's de	gree (1 major) Nanostru	cture Technology (20)	20)		
Bache	lor's de	gree (1 major) Mathema	atical Physics (2020)			
		gree (1 major) Quantum				
	s with 1 ma	or Mathematical Physics		• generated 19-Apr-2025 • example a formation of the second secon		page 106 / 119
2016)			ta record Bache	or (180 ECTS) Mathematische	PIIVSIK - 2016	



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

Module	e title				Abbreviation
Semina	ar Math	nematical Physics			11-SMP-162-m01
Module	e coord	linator		Module offered by	<u> </u>
•		f examination committee ematical Physics)	Mathematische	Faculty of Physics a	and Astronomy
ECTS Method of grading Only after succ. compl. of module(s)					
5	(not)	successfully completed			
Duratio	Duration Module level Other prerequisites				
1 seme	1 semester undergraduate				
Conten	ts				
A selec	ted top	bic of Mathematical Physi	cs.		
Intende	ed lear	ning outcomes			
	a give	n topic on the basis of lite			olves the development and divi- ell as the ability to actively partici
Course	<b>s</b> (type	, number of weekly conta	ict hours, language –	– if other than Germa	in)
S (2) Module	e taugh	t in: German or English			
		<b>sessment</b> (type, scope, la ion on whether module c			tion offered — if not every seme-
		o minutes) Issessment: German and	/or English		
Allocat	ion of	places			
Additio	onal inf	ormation			
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	ical Physics (2016)		
		gree (1 major) Mathemati	-		
Bachel	or's de	gree (1 major) Mathemati	ical Physics (2024)		

equations, electrostatics magnetic waves, special Intended learning outco	e Institute of Th ing e e evel iduate amics according s, magnetostati il relativity, cova	Only after succ. con  Other prerequisites  to the content of 11 ics, Maxwell equation	T-SEV. Among others ns in matter, dynami	11-T-EA-152-m01 nd Astronomy		
Managing Director of the and AstrophysicsECTSMethod of gradi5numerical grade5numerical gradeDurationModule le1 semesterundergradeContentsExercises in electrodyna equations, electrostatics magnetic waves, specialIntended learning outco	ing e evel aduate amics according cs, magnetostati al relativity, cova	Only after succ. con  Other prerequisites  to the content of 11 ics, Maxwell equation	Faculty of Physics a npl. of module(s) T-SEV. Among others ns in matter, dynami	nd Astronomy		
Managing Director of the and AstrophysicsECTSMethod of gradi5numerical gradeDurationModule le1 semesterundergradeContentsExercises in electrodyna equations, electrostatics magnetic waves, specialIntended learning outco	ing e evel aduate amics according cs, magnetostati al relativity, cova	Only after succ. con  Other prerequisites  to the content of 11 ics, Maxwell equation	Faculty of Physics a npl. of module(s) T-SEV. Among others ns in matter, dynami	nd Astronomy		
and AstrophysicsECTSMethod of gradi5numerical gradeDurationModule le1 semesterundergradeContentsExercises in electrodynaequations, electrostaticsmagnetic waves, specialIntended learning outcoIntended	ing e evel aduate amics according cs, magnetostati al relativity, cova	Only after succ. con  Other prerequisites  to the content of 11 ics, Maxwell equation	n <b>pl. of module(s)</b> T-SEV. Among others ns in matter, dynami			
5numerical gradeDurationModule le1 semesterundergradContentsExercises in electrodynaequations, electrostaticsmagnetic waves, specialIntended learning outco	e evel aduate amics according s, magnetostati al relativity, cova	 Other prerequisites  g to the content of 11 ics, Maxwell equation	T-SEV. Among others ns in matter, dynami			
DurationModule left1 semesterundergradContentsExercises in electrodynaequations, electrostaticsmagnetic waves, specialIntended learning outco	evel aduate amics according s, magnetostati al relativity, cova	 g to the content of 11 ics, Maxwell equation	T-SEV. Among others ns in matter, dynami			
1 semester undergrad Contents Exercises in electrodyna equations, electrostatics magnetic waves, special Intended learning outco	amics according s, magnetostati I relativity, cova	 g to the content of 11 ics, Maxwell equation	T-SEV. Among others ns in matter, dynami			
Contents Exercises in electrodyna equations, electrostatics magnetic waves, special Intended learning outco	amics according s, magnetostati Il relativity, cova o <b>mes</b>	ics, Maxwell equation	ns in matter, dynami			
Exercises in electrodyna equations, electrostatics magnetic waves, special Intended learning outco	s, magnetostati al relativity, cova omes	ics, Maxwell equation	ns in matter, dynami			
equations, electrostatics magnetic waves, special Intended learning outco	s, magnetostati al relativity, cova omes	ics, Maxwell equation	ns in matter, dynami			
			cs etc.	s Mathematical tools, Maxwell's c electromagnetic fields, electro-		
The students are familia	•.• .• ·					
				ynamics and are able to inde- amics and to interpret the results		
Courses (type, number o	of weekly conta	ct hours, language –	- if other than Germa	n)		
Ü (2) Module taught in: Ü: Ger	erman or English	1				
<b>Method of assessment</b> (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					
Allocation of places						
Additional information	Additional information					
Workload						
150 h						
Teaching cycle						
<b>Referred to in LPO I</b> (exa	amination regu	lations for teaching-	degree programmes)			
Module appears in	 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 Phys Bachelor's degree (1 ma	xchange program Physics (2023)					

Module title				Abbreviation
Theoretical Mechanics				11-T-MV-162-m01
Module coordinator			Module offered by	<u> </u>
Managing Director of the Institute of Theoretical Phy		heoretical Physics	Faculty of Physics a	and Astronomy
and Astrophy				
-	erical grade			
Duration	Module level	Other prerequisites	5	
1 semester Contents	undergraduate			
on, energy co 2. Lagrangian ons, mechani systems and 3. Hamiltonia Poisson brack Liouville theo 4. Application electromagne ring, cross se 5. Relativistic 6. Non-linear <b>Intended lear</b> The students	nservation; Harmonic os formulation: Variational ical gauge transformation apparent forces; n formulation: Legendre kets, canonical transform orem; Hamilton-Jacobi for ns: Central-force problem etic field; rigid bodies, to ction [optional]; dynamics: Lorentz Trans dynamics: Stability theo <b>rning outcomes</b> have gained first experie	cillator; Movement in principles, Euler-Lag ; symmetries, Noeth transformation, phas nations; generator of s mulation [optional]; s; mechanical simila rque and inertia tenso formation; Minkowsk ry; KAM theory [optio	space of intuition, or range equation; con er theorem, cyclic co e space; Hamilton fu symmetries, conserv rity, Virial theorem; r or, centrifugal and Eu ki space; equations of nal]; deterministic ch	straints; coordinate transformati- ordinates; accelerated reference unction, canonical equations; ation laws; minimal coupling; ninor vibrations; particles in an uler equations [optional]; scatte- of motion; naos [optional] Theoretical Physics. They are fa-
dently apply t to interpret th		al methods and tech ecially acquired know	niques to simple pro vledge of basic math	•
V (4)	,			
Method of as	<b>sessment</b> (type, scope, l ion on whether module o			ation offered — if not every seme-
	ination (approx. 120 min assessment: German and			
Allocation of	places			
Additional in	formation			
Workload				
150 h				
Teaching cyc	le			
Referred to in	LPOI (examination reg	ulations for teaching-	degree programmes)	
 Module appe	ars in			
Bachelor's de	egree (1 major) Mathemat	ical Physics (2016)		

Bachelor's with 1 major Mathematical Physics (2016)

Particle Physics (Standard Model)       Module offered by         Module coordinator       Module offered by         Managing Directors of the Institute of Applied Physics and the Institute of Theoretical Physics and Astrophysics       Faculty of Physics and Strophysics         ECTS       Method of grading       Only after succ. compl. of module(s)         8       numerical grade          Durationationation of the Standard Model       Other prerequisites         1 semester       undergraduate          Theoretical description of the Standard Model         Electroweak symmetry breaking through the Higgs mechanism       setting         Bhabha scattering         Z-Line Shape and forward / reverse asymmetry	11-TPS-152-mo1 Id Astronomy				
Managing Directors of the Institute of Applied Physics and the Institute of Theoretical Physics and Astrophysics       Faculty of Physics and the Institute of Theoretical Physics and Astrophysics         ECTS       Method of grading       Only after succ. compl. of module(s)         8       numerical grade          Duration       Module level       Other prerequisites         1 semester       undergraduate          Contents         Theoretical description of the Standard Model         Electroweak symmetry breaking through the Higgs mechanism parity Violation       Bhabha scattering	nd Astronomy				
Managing Directors of the Institute of Applied Physics and the Institute of Theoretical Physics and Astrophysics       Faculty of Physics and the Institute of Theoretical Physics and Astrophysics         ECTS       Method of grading       Only after succ. compl. of module(s)         8       numerical grade          Duration       Module level       Other prerequisites         1 semester       undergraduate          Contents           Theoretical description of the Standard Model       Electroweak symmetry breaking through the Higgs mechanism parity Violation         Bhabha scattering	nd Astronomy				
the Institute of Theoretical Physics and Astrophysics          ECTS       Method of grading       Only after succ. compl. of module(s)         8       numerical grade          Duration       Module level       Other prerequisites         1 semester       undergraduate          Contents       Theoretical description of the Standard Model       Electroweak symmetry breaking through the Higgs mechanism parity Violation         Bhabha scattering					
8       numerical grade          Duration       Module level       Other prerequisites         1 semester       undergraduate          Contents          Theoretical description of the Standard Model       Electroweak symmetry breaking through the Higgs mechanism parity Violation         Bhabha scattering					
Duration       Module level       Other prerequisites         1 semester       undergraduate          Contents         Theoretical description of the Standard Model         Electroweak symmetry breaking through the Higgs mechanism parity Violation         Bhabha scattering					
1 semester undergraduate Contents Theoretical description of the Standard Model Electroweak symmetry breaking through the Higgs mechanism parity Violation Bhabha scattering					
<b>Contents</b> Theoretical description of the Standard Model Electroweak symmetry breaking through the Higgs mechanism parity Violation Bhabha scattering					
Theoretical description of the Standard Model Electroweak symmetry breaking through the Higgs mechanism parity Violation Bhabha scattering					
Electroweak symmetry breaking through the Higgs mechanism parity Violation Bhabha scattering					
Higgs production and decay Experimental setup and results of key experiments to test the Standard Model an ters	d for determining its parame-				
Search for the Higgs boson					
Intended learning outcomes					
The students know the theoretical fundamental laws of the standard model of Particle Physics and the key ex- periments that have established and confirmed the standard model. They are able to interpret experimental or theoretical results in the framework of the standard model and know its validity and limits.					
<b>Courses</b> (type, number of weekly contact hours, language $-$ if other than German	)				
V (4) + R (2) Module taught in: German or English					
<b>Method of assessment</b> (type, scope, language — if other than German, examinati ster, information on whether module can be chosen to earn a bonus)	ion offered — if not every seme-				
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). f 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. anguage of assessment: German and/or English					
Allocation of places					
Additional information					
Workload					
240 h					
Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					

JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Mathematische Physik - 2016

page 111 / 119

# 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	title				Abbreviation	
Quantum Mechanics					11-T-QV-162-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Th and Astrophysics		eoretical Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5 numerical grade						
Duration Module level Other prerequisites						
1 semester undergraduate						
Content	ts					
quantur 2. Wave pulse m tionary 3. Form space a 4. Postu certaint 5. One-I try prop 6. Spin- two-leve 7. Angu solution 8. Centr 9. Motio Gauge t of a free 10. Spin 11. Addi 12. App time-de	<ul> <li>Contents</li> <li>1. History and basics: Limits of classical physics; fundamental historical experiments; from classical physics to quantum mechanics (QM);</li> <li>2. Wave function and Schrödinger equation (SG): SG for free particles; superposition; probability distribution for pulse measurement; correspondence principles: postulates of QM; Ehrenfest theorem; continuity equation; stationary solutions of SG</li> <li>3. Formalisation of QM: Eigenvalue equations; Physical significance of the eigenvalues of an operator; state space and Dirac notation; representations in state space; tensor products of state spaces;</li> <li>4. Postulates of QM (and their interpretation): State; measurement; chronological development; energy-time uncertainty;</li> <li>5. One-Dimensional problems: The harmonic oscillator; potential level; potential barrier; potential well; symmetry properties;</li> <li>6. Spin-1/2 systems I: Theoretical description in Dirac notation; Spin 1/2 in the homogeneous magnetic field; two-level systems (qubits);</li> <li>7. Angular momentum: Commutation and rotations; eigenvalues of the angular momentum operators (abstract); solution of the eigenvalue equation in polar coordinates (concrete);</li> <li>8. Central potential - hydrogen atom: Bonding states in 3D; Coulomb potential;</li> <li>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;</li> <li>10. Spin-1/2 systems II: Formulation using angular momentum algebra;</li> <li>11. Addition of angular momenta:</li> <li>12. Approximation methods: Stationary perturbation theory (with examples); variational method; WKB method; time-dependent perturbation theory;</li> <li>13. Atoms with several electrons: Identical particles; Helium atom; Hartree and Hartree-Fock approximation; ato-</li> </ul>					
Intende	d learr	ning outcomes				
miliar w techniq	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	<b>s</b> (type,	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
V (4)						
		essment (type, scope, la on on whether module ca			tion offered — if not every seme-	
		nation (approx. 120 minu ssessment: German and/				
Allocati	ion of p	olaces				
Additio	nal info	ormation				
l						

## Workload

150 h

Teaching cycle

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

--

--

# Module appears in

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

Bachelor's with 1 major Mathematical Physics
(2016)

Module					Abbreviation
Statist	ical Ph	ysics - Exercises			11-T-SA-152-m01
Module coordinator				Module offered by	
Managing Director of the Institute of The			peoretical Physics	Faculty of Physics a	and Astronomy
and Astrophysics					and Astronomy
ECTS					
5		rical grade			
Duratio	on	Module level	Other prerequisites	6	
1 seme	ster	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. nental theorems, thermodynamic cles, approximation methods,
Intende	ed lear	ning outcomes			
and are	e able t		nem to the description		dynamics and Statistical Physics blems of Statistical Physics and
Course	<b>s</b> (type	, number of weekly conta	act hours, language –	– if other than Germa	an)
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 <sub>l</sub>	olaces			
Additio	nal inf	ormation			
Worklo	ad				
150 h					
Teachi	ng cycl	e			
	<u>-3 -9 -1</u>	-			
Referre	d to in	LPOI (examination regu	lations for teaching.	degree programmes)	
Module	20002	ars in			
		gree (1 major) Physics (20	015)		
		gree (1 major) Physics (2)	-	5)	
		gree (1 major) Mathemat		21	
		gree (1 major) Mathemat			
		gree (1 major) Physics (2			
		gree (1 major) Nanostruc		20)	
		gree (1 major) Mathemat	•		
		gree (1 major) Quantum 1 gram Physics (2023)	rechnology (2021)		
		gree (1 major) Mathemat	ical Physics (2024)		
	uc				

Statist	e title				Abbreviation	
	ical Ph	ysics and Electrodynan	nics		11-T-SE-152-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Theoreti			Theoretical Physics	Faculty of Physics a	nd Astronomv	
and Astrophysics			,	, ,	,	
ECTS		od of grading	Only after succ. cor	nly after succ. compl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites	5		
2 seme	ester	undergraduate				
Conten	nts					
o. Prime cro-sta 1. Stati closed 2. Idea 3. Stati ralised 4. Ther thermo 5. Idea se-Eins 6. Syst ter sim 1 and 2 7. Critic BCS su 0); pro B. Elec o. Matl tence; 1. Max 2. Elec multipo ment a 3. Mag analog	ciples of ites; pro- istical F and op il system istical F forces modynam l System odynam l System stein co- ems of ulation 2 dimer cal phe upercon blems trodyna hematic Delta fi well eq trostati ole exp accordir netosta jes to e	Physics; of statistics: Elements of obability space (conditi Physics: Entropy and pro- pen systems (with energens: Spin systems; linear Physics and thermodyna- is; the second and third l amics: Thermodynamic ic machines (Carnot en- ms II, quantum statistic indensation; grids and interacting particles: A (Monte Carlo method)) isions); Yang-Lee-theor nomena: Scaling laws, ductivity); magnetism of the thermodynamic l amics; cal tools: Gradient, dive unction; Fourier transfou uations; cs: Coulomb's law; elec- ansion; Boundary value ing to orthogonal function atics: Current density; c electrostatics;	onal probability, statis obability theory; entrop gy and / or particle exc ar oscillators; ideal gas amics: The 1st law; qua aw; reversibility; trans fundamentals relation gine and efficiency); c s: Systems of identica normal modes: Phono pproximation methods ; interacting phonons ( ems; 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;	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 approximation quation for real intera fast variable as Bad low temperatures, qu urface, volume integra tems; solving PDEs; arged interface; elect solution; Image char	; s; thermodynamic e Physics to thermody c potentials; change ni gas; ideal Bose ga Sommerfeld expans n); Ising models (pa icting gases; (electron-phonon in iantum phase transi	quilibrium ir ature; gene- mamics; es of state; is and Bo- ion); compu rticularities i teraction and tions at T = ssian sen-
5. Dyna waves; on; ten 6. Spec effect, 7. Cova ler effe Intend The stu trodyna cepts a Course	amics o ; wave   nporall cial The energy ariant e ect; Lore ed lear udents amics, and to a	uations in matter: Elect f electromagnetic fields backets; plane waves in y oscillating sources an eory of Relativity: Lorent and momentum; co- an lectrodynamics: Field s entz force <b>ning outcomes</b> have advanced knowle thermodynamics and s uttribute them to bigger , number of weekly con	s: Faraday induction; R matter; cavity resona d dipole radiation; acc tz transform; simultane d contra-variant tenso trength tensor and Ma dge of the methods of tatistical mechanics. T physical contexts.	sceptibility; interface CL-circuits; field ene tors and wave guides celerated point charg eity; length contractio ors; covariant classica xwell's equations; tra Theoretical Physics. hey are able to discu	s; rgy and pulse; poter s; inhomogeneous w es; on and time dilation al mechanics; ansformation of the They know the princ ss the acquired theo	ntials; plane vave equati- ; light cone; fields; Dopp- iples of elec-
5. Dyna waves; on; ten 6. Spec effect, 7. Cova ler effe Intende The stu trodyna cepts a	amics o ; wave   nporall cial The energy ariant e ect; Lore ed lear udents amics, and to a	uations in matter: Elect f electromagnetic field backets; plane waves in y oscillating sources an eory of Relativity: Lorent and momentum; co- an lectrodynamics: Field s entz force <b>ning outcomes</b> have advanced knowle thermodynamics and s uttribute them to bigger	s: Faraday induction; R matter; cavity resona d dipole radiation; acc tz transform; simultane d contra-variant tenso trength tensor and Ma dge of the methods of tatistical mechanics. T physical contexts.	sceptibility; interface CL-circuits; field ene tors and wave guides celerated point charg eity; length contractio ors; covariant classica xwell's equations; tra Theoretical Physics. hey are able to discu	s; rgy and pulse; poter s; inhomogeneous w es; on and time dilation al mechanics; ansformation of the They know the princ ss the acquired theo	ntials; plane vave equati- ; light cone; fields; Dopp iples of elec

**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

--

#### **Additional information**

--

Workload

180 h Teaching cycle

TCut

**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	Ι
(2016)	l

Modul					Abbreviation
Theore	tical M	echanics and Quantum I	Mechanics - Excercis	es	11-T-TMQ-162-m01
Module coordinator				Module offered by	<u> </u>
Managing Director of the Institute of Th			neoretical Physics	Faculty of Physics a	and Astronomy
and Astrophysics					
ECTS	Metho	od of grading	Only after succ. cor	npl. of module(s)	
6	(not) s	successfully completed			
Duratio	on	Module level	Other prerequisites	5	
2 seme	ester	undergraduate			
Conten	ts				
ding le on, ene formula nical g and ap bracke theore minor ler equ kowski chaos stulate moving electro Intende The stu miliar	cture. A ergy con ation, v auge tra parent ts, cano m; Ham vibratio ations s paces (option s of QM g in the ns, etc. ed learn udents with the	Among others: inertial synservation; harmonic ose variational principles, Eul ansformation; symmetrie powers, Legendre transformations; g nilton-Jacobi formulation ns; particles in an electr [optional]; scattering, cre ; equations of motion, no al], wave function and So A, dimensional problems electromagnetic field, and bave gained first experie e principles of theoretica	stems, Newton's law cillator; movement in ler-Lagrange equation es, Noether theorem, ormation, phase spa generator of symmetr [optional], central fo omagnetic field; rigic oss section [optional] on-linear dynamics, s chrödinger equation dition of angular mo nces concerning the l mechanics, their dif	s of motion, equation space of intuition, c r; constraints; coord cyclic coordinates; a ce; Hamilton function ies, conservation law rce problems; mecha l bodies, torque and l, relativistic dynamic tability theory; KAM (SG), formalisation o ingular momentum, comenta, approximation working methods of ferent formulations a	the contents of the correspon- ns of motion; Dimensional motions of motion; Dimensional motions of motion; Dimensional motions evaluation; Dimensional motions are conservative forces, Lagrangian in the transformation; Poisson vs; minimal coupling; Liouville anical similarity, Virial theorem; inertia tensor, centrifugal and E cs, Lorentz transformation; Min theory [optional]; deterministic f QM, eigenvalue equations, potentral potential, hydrogen ator on methods, atoms with severa theoretical Physics. They are far and the mathematical methods and technique for the technique for tech
to simp tion of	ole prot problei	olems of Theoretical Phy	sics, to interpret the r hey have especially a	esults and to apply t	matical methods and technique them to the description and sol of basic mathematical concepts
Course	<b>s</b> (type	, number of weekly conta	act hours, language –	– if other than Germa	an)
Ü (2) + Module	• •	t in: German or English			
		sessment (type, scope, la ion on whether module c			ation offered — if not every sem
To pass inform	s the as studen	t complete approx. 13 ex sessment, students mu ts about the respective of ssessment: German and	st successfully comp letails at the beginni	lete approx. 50% of t	hese exercises. The lecturer wi
Allocat	ion of <sub>l</sub>	olaces			
Additio	onal inf	ormation			
Worklo	oad				
<b>Worklo</b> 180 h	oad				
180 h		e			
		e			
180 h <b>Teachi</b> 	ng cycl	e		• generated 19-Apr-2025 • ex	

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

## Module appears in

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

Bachelor's with 1 major Mathematical Physics	
(2016)	