

## Subdivided Module Catalogue for the Subject

# **Computational Mathematics**

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

> Examination regulations version: 2012 Responsible: Institute of Mathematics

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record 88|f24|-|-|H|2012

### **Course of Studies - Contents and Objectives**

The Master programme Computational Mathematics is offered by the Department of Mathematics, with a total of currently (as of March 2014) 11 chairs.

The Master study programme in Computational Mathematics is intended to provide the students with the following qualifications:

- capacity of abstraction,
- rigour in analytic reasoning,
- excellent capacity to realize the structure of complex interrelations,
- sound qualification in applying mathematical methods to specific problems,
- insight into the intrinsic mathematical interdependence of different mathematical fields, in particular in Applied Mathematics, as well as into interdisciplinary relations in computer science, medicine, natural and engineering sciences,
- high capacity in problem solving,
- ability to carry out scientific work independently and on a high level,
- ability to cooperate responsibly within an interdisciplinary team of mathematicians, computer scientists, medical and natural scientists and engineers,
- ability to apply mathematical methods and algorithms, in particular from modelling, optimisation, simulation and scientific computing, in the context of life science, natural science or engineering,
- insight into and overview over current research in at least one field of contemporary mathematics,
- qualification for meeting the standards of a Ph.D. programme in mathematics (if applicable).

For the Master thesis the student works independently on a topic in Applied Mathematics and solves a problem within a limited time frame, following scientific criteria and applying established methods or modifying them if necessary.

The Master exam ascertains that the candidate has a good overview in the field of Computational Mathematics and possesses the ability to use the corresponding scientific methods independently. The degree Master of Science in Computational Mathematics constitutes a further professional and scientific qualification.

## 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:

#### ASP02009

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

#### 12-Jul-2012 (2012-106)

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.

## The subject is divided into

Abbreviation	Module title		ECTS	Method of	nage			
				grading	page			
Compulsory Electives (90 ECTS credits)								
Compulsory Electives Mathematics								
Applied Mathematics								
10-M=VKOM-122-m01	Mathemati	cal Continuum Mechanics	5	NUM	109			
10-M=AAAN-102-m01	Applied An	alysis	10	NUM	65			
10-M=ANGG-102-m01	Numeric of	large Systems of Equations	10	NUM	79			
10-M=AOPT-102-m01	Basics of C	ptimization	10	NUM	81			
10-M=VNPE-102-m01	Numeric of	Partial Differential Equations	10	NUM	117			
10-M=VOPT-102-m01	Selected To	opics in Optimization	10	NUM	119			
10-M=VMPH-102-m01	Selected To	opics in Mathematical Physics	5	NUM	113			
10-M=VOST-102-m01	Optimal Co	ontrol	5	NUM	121			
Mathematics	~							
10-M=VANA-122-m01	Selected To	opics in Analysis	10	NUM	101			
10-M=VGPC-122-m01	Giovanni-P	rodi Lecture Selected Topics (Master)	10	NUM	107			
10-M=ELTCM-122-m01	Learning by	y Teaching Computational Mathematics	5	NUM	91			
10-M=ARTH-102-m01	Introductio	n to Control Theory	10	NUM	83			
10-M=AALG-102-m01	Topics in A	lgebra	10	NUM	67			
10-M=ADGM-102-m01	Differentia	Geometry	10	NUM	69			
10-M=AFTH-102-m01	Complex A	nalysis	10	NUM	71			
10-M=AGMS-102-m01	Geometric	Geometric Structures		NUM	73			
10-M=ALTH-102-m01	Lie Theory	ie Theory		NUM	77			
10-M=ASTP-102-m01	Stochastic	Stochastical Processes		NUM	85			
10-M=ATOP-102-m01	Topology			NUM	87			
10-M=AZTH-102-m01	Number Th	eory	10	NUM	89			
10-M=AGPC-102-m01	Giovanni-P	rodi Lecture (Master)	5	NUM	75			
10-M=VGDS-102-m01	Groups and	d their Representations	10	NUM	105			
10-M=VDSR-102-m01	Dynamical	Systems and Control	5	NUM	103			
10-M=VMBV-102-m01	Mathemati	cal Imaging	5	NUM	111			
10-M=VNAN-102-m01	Non-Linear	Analysis	5	NUM	115			
Workshops and Seminars	5		1	<u> </u>				
10-M=GMNW-122-m01	Study Grou	p Mathematics in the Sciences	10	NUM	92			
10-M=SMNW-122-m01	Seminar in	Mathematics in the Sciences	5	NUM	98			
10-M=GNMA-102-m01	Study Grou	p Numerical Mathematics and Applied Analysis	10	NUM	93			
10-M=GROK-102-m01	Study Grou	p Robotic, Optimization and Control Theory	10	NUM	94			
10-M=SGPC-102-m01	Giovanni-P	Giovanni-Prodi Seminar (Master)		NUM	96			
10-M=SIDZ-102-m01	Interdisciplinary Seminar		5	NUM	97			
10-M=SNMA-102-m01	Seminar in Numerical Mathematics and Applied Analysis		5	NUM	99			
10-M=SOPT-102-m01	Seminar in	Optimization	5	NUM	100			
Application-oriented Subje	ect			1	<u>.</u>			
Application-oriented Sub	ject Biology	/						
Topics: Bioinformatics								
07-MBI-B-121-m01	Bioinforma	tics B	5	B/NB	9			
Master's with 1 major Computational Mathematics     JMU Würzburg • generated 26-Aug-2024 • exam. reg. data re- cord Master (120 ECTS) Computational Mathematics - 2012     page 4 /					4 / 172			

07-MS2BI-102-m01	Bioinformatics (Lecture and Seminar)	10	NUM	10				
07-MS2BIF1-102-m01	Bioinformatics (Practical Course and Seminar 1)	10	NUM	11				
07-MS2BIF2-102-m01	Bioinformatics (Practical Course and Seminar 2)	15	B/NB	12				
Topics: System Biology								
07-MS-B-121-m01	Systems Biology B	5	B/NB	16				
07-MS3S-102-m01	System Biology (Lecture and Seminar)	10	NUM	13				
07-MS3SYF1-102-m01	System Biology (Practical Course and Seminar 1)	10	NUM	14				
07-MS3SYF2-102-m01	System Biology (Practical Course and Seminar 2)	15	B/NB	15				
Application-oriented Sub	ject Chemistry		·	•				
Theoretical Chemistry								
08-TCM2-102-m01	Computational Chemistry	5	NUM	27				
08-TCM1-102-m01	Theoretical Chemistry	5	NUM	26				
08-TCM3-102-m01	Programming in Theoretical Chemistry	5	NUM	28				
08-TCAP-102-m01	Theoretical Chemistry - Project work	10	B/NB	24				
Physical Chemistry								
08-PCM1-102-m01	Advanced Physical Chemistry	10	NUM	17				
08-PCM2-102-m01	Chemical Dynamics	5	NUM	19				
08-PCM3-102-m01	Nanoscale Materials	5	NUM	20				
08-PCM4-102-m01	Ultrafast spectroscopy and quantum-control	5	NUM	21				
08-PCM5-102-m01	Physical chemistry of supramolecular assemblies	5	NUM	22				
08-PCM6-102-m01	PCM6-102-mo1 Physical Chemistry (Advanced Lab)							
Application-oriented Sub	ject Medicine		•					
03-MaMed1-122-m01	Applied Mathematics and Medicine	10	NUM	7				
02-M2Mod2-122-m01	Practical Research Course Medicine and Computational Mathe-	15	NILIM	Q				
03-maimeu2-122-m01	matics	15	NOM	0				
Application-oriented Sub	ject Computer Science							
10-I-AGT-122-m01	Algorithmic Graph Theory	5	NUM	52				
10-l-DB-102-m01	Databases	5	NUM	55				
10-I-WBS-102-m01	Knowledge-based Systems	5	NUM	64				
10-I-DM-102-m01	Data Mining	5	NUM	57				
10-I-KT-102-m01	Theory of Complexity	5	NUM	58				
10-I-AR-102-m01	Automation and Control Technology	8	NUM	53				
10-I-RK-102-m01	Computer Networks and Communication Systems	8	NUM	62				
10-I=KI-102-m01	Artificial Intelligence	8	NUM	41				
10-I=EL-102-m01	E-Learning	5	NUM	38				
10-I=MI-102-m01	Medical Informatics	5	NUM	43				
10-I=DDB-102-m01	Deductive Databases	8	NUM	37				
10-I=DB2-102-m01	Databases II		NUM	36				
10-I=ST-102-m01	Simulation Techniques for Performance Evaluation		NUM	51				
10-I=KT2-102-m01	Advanced Topics in Computational Complexity		NUM	42				
10-I=KD-102-m01	Cryptography and Data Security		NUM	40				
10-I=AG-102-m01	Computational Geometry		NUM	30				
10-I=APA-102-m01	Approximation Algorithms		NUM	32				
10-I=AGIS-102-m01	Algorithms for Geographic Information Systems		NUM	31				
10-l=CB-102-m01	Compiler Construction	8	NUM	35				
10-I=PA-102-m01	Program Design and Analysis	5	NUM	45				
Master's with 1 major Computational	Mathematics JMU Würzburg • generated 26-Aug-2024 • exam. reg cord Master (120 ECTS) Computational Mathematic	. data re- s - 2012	page	5 / 172				

10-I=RAM-102-m01	Computer /	Computer Arithmetic		NUM	46		
10-I=AUT-102-m01	Automata 1	utomata Theory		NUM	33		
10-I=BER-102-m01	Computabi	ility Theory	5	NUM	34		
10-I=ML-102-m01	Mathemati	cal Logic	5	NUM	44		
Application-oriented Subject Aerospace Computer Science							
10-I-AR-102-m01	Automatio	n and Control Technology	8	NUM	53		
10-I-RAK-102-m01	Computer /	Architecture	5	NUM	60		
10-I-RK-102-m01	Computer I	Networks and Communication Systems	8	NUM	62		
10-I=ES-102-m01	Embedded	Systems	8	NUM	39		
10-I=RO-102-m01	Robotics		8	NUM	47		
10-l=SSD-102-m01	Spacecraft	Systems Design	8	NUM	50		
10-I=AA-102-m01	Advanced <i>i</i>	Automation	8	NUM	29		
10-I=RO2-102-m01	Robotics II:	: Networked Robots	8	NUM	49		
Application-oriented Sub	ject Physic	5					
Solid State Physics and	Nanostruct	tures (Experiment)					
11-HLF-092-m01	Semicondu	uctor Lasers - Principles and Current Research	6	NUM	141		
11-FK2-092-m01	Solid State	Physics 2	8	NUM	135		
11-FKS-092-m01	Solid State	Spectroscopy	6	NUM	137		
11-HLP-092-m01	Semicondu	actor Physics	6	NUM	143		
11-HNS-092-m01	Semicondu	uctor Nanostructures	6	NUM	145		
11-SPD-102-m01	Semicondu	actor Physics and Devices	6	NUM	159		
Astrophysics and Particle Physics (Experiment)							
11-A4-072-m01	Astrophysi	cs	6	NUM	123		
11-AWP-092-m01	Atmospher	re and Space Physics	6	NUM	131		
11-TPE-092-m01	Experimen	xperimental Particle Physics		NUM	167		
11-TPS-092-m01	Particle Physics (Standard Model)		8	NUM	169		
Complex Systems, Quantum Control and Biophysics (Experiment)							
11-SDC-092-m01	Statistics,	Data Analysis and Computer Physics	4	NUM	157		
Solid State Physics and	Nanostruct	tures (Theory)					
11-QM2-092-m01	Quantum N	Aechanics II	8	NUM	149		
11-TFK-092-m01	Theoretica	l Solid State Physics	8	NUM	165		
11-TSL-092-m01	Theory of S	Superconduction	5	NUM	171		
Astrophysics and Partic	le Physics (	(Theory)					
11-EPP-092-m01	Introductio	n to Plasmaphysics	6	NUM	133		
11-AKM-092-m01	Cosmology	1	6	NUM	125		
11-APL-092-m01	Plasma-Ast	trophysics	6	NUM	127		
11-ASP-092-m01	Introductio	Introduction to Space Physics		NUM	129		
11-GRT-092-m01	Group Theo	Group Theory		NUM	139		
11-RNT-092-m01	Renormaliz	Renormalization Theory		NUM	151		
11-RQFT-092-m01	Relativistic	Relativistical Quantumfield Theory		NUM	153		
11-RTT-092-m01	Theory of Relativity		6	NUM	155		
11-TEP-092-m01	Theoretical Elementary Particle Physics		8	NUM	163		
11-SUS-092-m01	Supersymr	netry I and II	6	NUM	161		
11-NMA-111-m01	Computati	onal Astrophysics	6	NUM	147		
Thesis (30 ECTS credits)							
10-M=MACM-102-m01	Master The	esis Computational Mathematics	30	NUM	95		
Master's with 1 major Computational Mathematics     JMU Würzburg • generated 26-Aug-2024 • exam. reg. data re- cord Master (120 ECTS) Computational Mathematics - 2012     page 6 / 172							

Applied Mathematics and Medicine       03-MaMed1-122-mo1         Module coordinator       Module offered by         Chair of Rudolf Virchow Center for Experimental Biomedicione       Faculty of Medicine         ne       Faculty of Medicine         ECTS         Method of grading       Only after succ. compl. of module(s)         10       num=rical grade          Duration       Module level       Other prerequisites         1 semester       graduate          Conterts         Applications of mathematical modelling and analysis in medicine and, in particular, in genomics, proteomics, cellular modelling and quantitative image analysis.         Intended learning outcomes         Students have acquired an insight into various application areas of applied mathematics in the life sciences.					
Module coordinator       Module offered by         Chair of Rudolf Virchow Center for Experimental Biomedicine       Faculty of Medicine         ne       Faculty of Medicine         ECTS       Method of grading       Only after succ. compl. of module(s)         10       numerical grade          Duration       Module level       Other prerequisites         1 semester       graduate          Contents       Contents       Intended learning outcomes         Intended learning outcomes       Students have acquired an insight into various application areas of applied mathematics in the life sciences.					
Chair of Rudolf Virchow Center for Experimental Biomedicine       Faculty of Medicine         Image: Provide the stress of applied mathematics in the life sciences.       Faculty of Medicine         Image: Provide the stress of applied mathematics in the life sciences.       Faculty of Medicine         Image: Provide the stress of applied mathematics in the life sciences.       Faculty of Medicine         Image: Provide the stress of applied mathematics in the life sciences.       Faculty of Medicine         Image: Provide the stress of applied mathematics in the life sciences.       Faculty of Medicine					
ECTS       Method of grading       Only after succ. compl. of module(s)         10       numerical grade          Duration       Module level       Other prerequisites         1 semester       graduate          Contents        Outing and analysis in medicine and, in particular, in genomics, proteomics, cellular modelling and quantitative image analysis.         Intended learning outcomes       Students have acquired an insight into various application areas of applied mathematics in the life sciences.					
10       numerical grade          Duration       Module level       Other prerequisites         1 semester       graduate          Contents          Applications of mathematical modelling and analysis in medicine and, in particular, in genomics, proteomics, cellular modelling and quantitative image analysis.         Intended learning outcomes       Students have acquired an insight into various application areas of applied mathematics in the life sciences.					
DurationModule levelOther prerequisites1 semestergraduateContentsApplications of mathematical modelling and analysis in medicine and, in particular, in genomics, proteomics, cellular modelling and quantitative image analysis.Intended learning outcomesStudents have acquired an insight into various application areas of applied mathematics in the life sciences.					
1 semester       graduate          Contents         Applications of mathematical modelling and analysis in medicine and, in particular, in genomics, proteomics, cellular modelling and quantitative image analysis.         Intended learning outcomes       Students have acquired an insight into various application areas of applied mathematics in the life sciences.					
Contents         Applications of mathematical modelling and analysis in medicine and, in particular, in genomics, proteomics, cellular modelling and quantitative image analysis.         Intended learning outcomes         Students have acquired an insight into various application areas of applied mathematics in the life sciences.					
Applications of mathematical modelling and analysis in medicine and, in particular, in genomics, proteomics, cellular modelling and quantitative image analysis. Intended learning outcomes Students have acquired an insight into various application areas of applied mathematics in the life sciences.					
Intended learning outcomes Students have acquired an insight into various application areas of applied mathematics in the life sciences.					
Students have acquired an insight into various application areas of applied mathematics in the life sciences.					
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)					
V + S (no information on SWS (weekly contact hours) and course language available)					
<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)					
talk (approx. 60 to 120 minutes) Language of assessment: German, English					
Allocation of places					
Additional information					
Workload					
Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
Master's degree (1 major) Computational Mathematics (2012)					

Module title					Abbreviation	
Practica	Practical Research Course Medicine and Computational Ma			thematics	03-MaMed2-122-m01	
Module	e coord	inator		Module offered by		
Chair of ne	f Rudol	f Virchow Center for Expe	rimental Biomedici-	Faculty of Medicine		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
15	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Practica	al appli	ication of mathematical a	nd bioinformatic me	thods in biomedical	research projects.	
Intende	ed lear	ning outcomes				
Studen	ts have	e gained practical experie	nce in the applicatio	n areas of applied m	athematics in the life sciences.	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	· if other than Germa	ın)	
R (no in	format	ion on SWS (weekly cont	act hours) and cours	e language available	2)	
Methoo ster, inf	<b>l of ass</b> formati	<b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
talk (ap Langua	prox. 6 ge of a	50 to 120 minutes) and pi ssessment: German, Eng	roject report (approx. lish	10 to 20 pages)		
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module	Module appears in					
Master	Master's degree (1 major) Computational Mathematics (2012)					

Module title			Abbreviation		
Bioinformatics B			07-MBI-B-121-m01		
Module	e coord	inator		Module offered by	
holder	of the (	Chair of Bioinformatics		Faculty of Biology	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	(not) s	successfully completed			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Advanc and sec quence	es and quence s, prot	current results of bioinfo analysis, protein domain eomics data), analysis of	ormatics are explaine ns and protein familie different functional I	d and discussed, thi es, large-scale data a RNAs (e. g. miRNAs,	is includes results from genome analysis (e. g. net generation se- IncRNAs).
Intende	ed learı	ning outcomes			
Unders <sup>.</sup> ledge o	tand re f typica	cent results in bioinform al technologies and resea	atics. Discuss their ir Irch questions in bioi	nplications. Have an nformatics.	advanced (Master) level know-
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	· if other than Germa	n)
V (no in	format	ion on SWS (weekly cont	act hours) and cours	e language available	2)
Method ster, inf	<b>l of ass</b> formati	<b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
Studen examin each (3	ts will I ation ( 0 to 60	be informed about the mo 30 to 60 minutes, includi 9 minutes) or c) oral exam	ethod, length and sco ng multiple choice qu ination in groups of	ope of the assessme uestions) or b) oral e up to 3 candidates (?	nt prior to the course. a) written examination of one candidate 30 to 60 minutes)
Allocat	ion of p	olaces	0 1		
	· ·				
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ıg cycl	e			
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Master'	's degr	ee (1 major) Biology (201	L)		
Master'	's degr	ee (1 major) Biology (2014	4) ()		
Master'	s degr	ee (1 major) Mathematics	(2012)		
Master Master	s uegro	ee (1 major) Biomedicine	(2013)		
Master'	's degr	ee (1 major) Computation	al Mathematics (201	2)	

Module title			Abbreviation		
Bioinformatics (Lecture and Seminar)				07-MS2BI-102-m01	
Module	coord	inator		Module offered by	
holder	of the C	hair of Bioinformatics		Faculty of Biology	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	numei	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate			
Conten	ts				
Advanc and sec quence	es and quence s, prote	current results of bioinfo analysis, protein domain eomics data), analysis of	ormatics are explainents and protein familient different functional F	d and discussed, thi es, large-scale data a RNAs (e. g. miRNAs, l	s includes results from genome analysis (e. g. net generation se- IncRNAs).
Intende	d learr	ning outcomes			
Unders ledge o	tand re f typica	cent results in bioinform I technologies and resea	atics. Discuss their in Irch questions in bioi	nplications. Have an nformatics.	advanced (Master) level know-
Courses	<b>s</b> (type,	, number of weekly conta	ct hours, language —	if other than Germa	n)
S + V (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)
Method ster, inf	<b>l of ass</b> ormati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
Student one of t questio up to 3	ts will h he follo ns) or l candid	be informed about the me owing options will be cho b) oral examination of on ates (approx. 30 to 60 m	ethod, length and sco osen: a) written exam e candidate each (30 inutes)	ope of the assessme ination (30 to 60 min to 60 minutes) or c)	nt prior to the course. Usually, nutes, including multiple choice ) oral examination in groups of
Allocati	ion of p	olaces			
Additio	nal info	ormation			
Worklo	ad				
Teachin	ig cycl	9			
Module appears in					
Master' Master' Master' Master' Master' Master'	s degre s degre s degre s degre s degre s degre	ee (1 major) Biochemistry ee (1 major) Biology (2012 ee (1 major) Biology (2010 ee (1 major) Biology (2010 ee (1 major) Biology (2010 ee (1 major) Mathematics ee (1 major) Computation	(2012) 1) 5) 4) (2012) al Mathematics (2012	2)	

Module title				Abbreviation		
Bioinformatics (Practical Course and Seminar 1)			07-MS2BIF1-102-m01			
Module	e coord	inator		Module offered by		
holder	of the C	Chair of Bioinformatics		Faculty of Biology		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	Contents					
Detaile mics (s proteor netic ar a term	d insig equenc nics), t nalysis, paper.	ht into methods in bioinfice-, domain analysis and opological and structural , protein structure analys	ormatics; depending annotation), omics d analysis of biologica is. Results are docum	on the topic selecter ata analysis (NGS, tr I interactions includ rented in the form of	d, fields covered include: geno- ranscriptomics, metabolomics, ling statistical methods, phyloge- a presentation, a publication or	
Intende	ed learr	ning outcomes				
Studen are able scientif	ts have e to des ic prac	e gained knowledge on ex sign experiments, collect tice.	operimental setups ar data and interpret th	nd methods used in em statistically, adh	the field of bioinformatics. They hering to the principles of good	
Course	<b>s</b> (type,	, number of weekly conta	ct hours, language —	if other than Germa	n)	
S + P (n	io infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)	
Methoo ster, in	<b>l of ass</b> formati	e <b>ssment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
Studen followin or b) lo aminat	ts will I ng optio g (appr ion in g	be informed about the len ons will be chosen: a) wri ox. 10 to 30 pages) or c) groups of up to 3 candida	ngth and scope of the itten examination (30 oral examination of o tes (approx. 30 to 60	e assessment prior to to 60 minutes, inclu ne candidate each ( minutes) or e) prese	o the course. Usually, one of the uding multiple choice questions) 30 to 60 minutes) or d) oral ex- entation (20 to 45 minutes)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
<b>Referred to in LPO L</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Biology (2011)						
Master's degree (1 major) Biology (2010)						
Master	's degre	ee (1 major) Biology (201	4)			
Master	's degre	ee (1 major) Mathematics	(2012)			
Master	Master's degree (1 major) Computational Mathematics (2012)					

Modu	le title		Abbreviation			
Bioinf	ormatic	s (Practical Course and S	eminar 2)		07-MS2BIF2-102-m01	
Modu	le coord	inator		Module offered by		
holde	r of the (	Chair of Bioinformatics		Faculty of Biology		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
15	(not) s	successfully completed				
Durati	on	Module level	Other prerequisites			
1 sem	ester	graduate	Admission prerequisite to assessment: regular attendance of lab cou			
			and successful com	pletion of the respec	tive exercises as specified at the	
			beginning of the cou	irse.		
Conte	nts					
mics ( protect netic a ned an term p	sequent omics), t analysis nd are m paper.	ce-, domain analysis and copological and structural , protein structure analys nodified where necessary	annotation), omics d analysis of biologica is. The techniques ap . Results are docume	ata analysis (NGS, tal interactions includ oplied are evaluated nted in the form of a	ranscriptomics, metabolomics, ling statistical methods, phyloge- on the basis of the results obtai- presentation, a publication or a	
mieno	ieu iear					
Profici se a s design	iency in cientific n a resea	one or more methods in project in the field of bio arch project and are prep.	bioinformatics that al informatics and to do ared for working on a	lows students to inc ocument the results scientific question f	lependently perform and organi- obtained. Students are able to for their thesis.	
Cours	es (type	number of weekly conta	ct hours, language -	if other than Germa	n)	
S + P	no infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)	
Mothe		accord (type score la	nguago — if other the	an Corman, ovamina	tion offered — if not even some	
ster, i	nformati	ion on whether module ca	an be chosen to earn	a bonus)		
Stude follow or b) l amina	nts will ing opti og (appi tion in g	be informed about the ler ons will be chosen: a) wr rox. 10 to 30 pages) or c) groups of up to 3 candida	ngth and scope of the itten examination (30 oral examination of o tes (approx. 30 to 60	e assessment prior to to 60 minutes, inclu ne candidate each ( minutes) or e) prese	o the course. Usually, one of the uding multiple choice questions) 30 to 60 minutes) or d) oral ex- entation (20 to 45 minutes)	
Alloca	tion of <sub>l</sub>	places				
Additi	onal inf	ormation				
Workl	oad					
Teach	Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Maste	r's degr	ee (1 major) Biology (201	1)			
Maste	Master's degree (1 major) Biology (2010)					
Maste	r's degr	ee (1 major) Biology (201	4)			
Maste	r's degr	ee (1 major) Mathematics	5 (2012)	<b>`</b>		
Maste	Master's degree (1 major) Computational Mathematics (2012)					

Master's with 1 m	ajor Computational	Mathematics
(2012)		

Module title			Abbreviation		
System Biology (Lecture and Seminar)				07-MS3S-102-m01	
Module	coord	inator		Module offered by	
holder	of the (	Chair of Bioinformatics		Faculty of Biology	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate			
Conten	ts				
Advanc sults fro as regu	es and om fun latory i	current results of compu ctional genomics, dynam networks.	tational systems bio ics of the transcripto	logy are explained a me, of metabolism a	nd discussed, this includes re- ind metabolic networks as well
Intende	ed learı	ning outcomes			
Underst ledge o	tand re f typica	cent results in systems b al technologies and resea	iology. Discuss their Irch questions of syst	implications. Have a tems biology.	an advanced (Master) level know-
Courses	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
S + V (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)
Method ster, inf	<b>l of ass</b> formati	<b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
Student one of t questio up to 3	ts will l he foll ns) or candid	be informed about the me owing options will be cho b) oral examination of on lates (approx. 30 to 60 m	ethod, length and sco osen: a) written exam e candidate each (3c inutes)	ope of the assessme ination (30 to 60 min o to 60 minutes) or c)	nt prior to the course. Usually, nutes, including multiple choice ) oral examination in groups of
Allocati	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
Master'	s degr	ee (1 major) Biology (2011	l)		
Master's degree (1 major) Biology (2010)					
Master'	s degr	ee (1 major) Biology (2014	4)		
Master'	s degr	ee (1 major) Mathematics	(2012)	- )	
Master'	Master's degree (1 major) Computational Mathematics (2012)				

Module	title				Abbreviation
System Biology (Practical Course and Seminar 1)				07-MS3SYF1-102-m01	
Module	e coord	inator		Module offered by	
holder	of the C	Chair of Bioinformatics		Faculty of Biology	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
The pra ticular, protein namics ling).	ctical c make s structu of prot	course will provide studen students proficient in a d ure analysis and protein f tein-protein interactions,	nts with advanced ins ynamical method in s olding, genome analy modelling cellular re	sights into a field of systems biology (are ysis and evolution; c gulation; modelling	systems biology and will, in par- as that may be selected include dynamic network analysis, the dy- metabolism, statistical model-
Intende	ed learr	ning outcomes			
Studen They ar ciples c	ts have e able t of good	e gained knowledge on ex to design scientific resea scientific practice.	xperimental setups an rch, to collect data an	nd methods used in nd to interpret them	the field of systems biology. statistically, adhering to the prin-
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
P + S (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)
Methoo ster, inf	<b>l of ass</b> formati	<b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
Studen followir or b) log aminat	ts will I ng optio g (appr ion in g	be informed about the len ons will be chosen: a) wri ox. 10 to 30 pages) or c) groups of up to 3 candida	ngth and scope of the itten examination (30 oral examination of o tes (approx. 30 to 60	e assessment prior to to 60 minutes, inclu ne candidate each ( minutes) or e) prese	o the course. Usually, one of the uding multiple choice questions) 30 to 60 minutes) or d) oral ex- entation (20 to 45 minutes)
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Worklo	ad				
Teachir	ng cycl	e			
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
Master	's degre	ee (1 major) Biology (201:	1)		
Master's degree (1 major) Biology (2010)					
Master	's degre	ee (1 major) Biology (201	4)		
Master	's degre	ee (1 major) Mathematics	al Mathematics (2012)	2)	
master	Master's degree (1 major) computational mathematics (2012)				

Module title					Abbreviation		
System Biology (Practical Course and Seminar 2) 07-MS3SYF2-102-					07-MS3SYF2-102-m01		
Modul	e coord	inator		Module offered by			
holder	of the (	Chair of Bioinformatics		Faculty of Biology			
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
15	(not) s	successfully completed					
Durati	on	Module level	Other prerequisites				
1 Seme	ester	graduate	Admission prerequis and successful com beginning of the cou	site to assessment: ı pletion of the respec ırse.	regular attendance of lab course tive exercises as specified at the		
Conte	nts						
The pr ticular protein namic ling). 1 sarv. R	actical o , make : n structu s of pro The tech desults a	course will provide stude students proficient in a d ure analysis and protein f tein-protein interactions, uniques applied are evalu are documented in the fo	nts with advanced in ynamical method in olding, genome anal modelling cellular re ated on the basis of rm of a presentation.	sights into a field of systems biology (are ysis and evolution; o gulation; modelling the results obtained a publication or a te	systems biology and will, in par- as that may be selected include lynamic network analysis, the dy- metabolism, statistical model- and are modified where neces- erm paper.		
Intend	ed lear	ning outcomes	,		h sh s s		
Profici nise a desigr	ency in scientif a resea	one or more methods in a ic project in the field of b arch project and are prep	systems biology that ioinformatics and to ared for working on a	allows students to in document the result scientific question f	ndependently perform and orga- s obtained. Students are able to for their thesis.		
Course	es (type	, number of weekly conta	ct hours, language —	if other than Germa	n)		
P + S (	no infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)		
<b>Metho</b> ster, ir	<b>d of ass</b> formati	sessment (type, scope, la ion on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
Studer follow or b) lo amina	nts will ing opti og (appi tion in g	be informed about the ler ons will be chosen: a) wr rox. 10 to 30 pages) or c) groups of up to 3 candida	ngth and scope of the itten examination (3c oral examination of o tes (approx. 30 to 60	e assessment prior to to 60 minutes, inclu ne candidate each ( minutes) or e) prese	o the course. Usually, one of the uding multiple choice questions) 30 to 60 minutes) or d) oral ex- entation (20 to 45 minutes)		
Alloca	tion of <sub>l</sub>	olaces					
Additi	onal inf	ormation					
Workl	oad						
Teach	ing cycl	e					
			,				
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)							
-							
Modul	Module appears in						
Maste	r's degr	ee (1 major) Biology (201:	1)				
Maste	r's degr	ee (1 major) Biology (201	o)				
Maste	r's degr	ee (1 major) Biology (201	4)				
Maste	r's degr	ee (1 major) Mathematics	(2012)	<b>a</b> )			
waste	Master's degree (1 major) Computational Mathematics (2012)						

Master's with 1 major Computational Mathematics
(2012)

Module title				Abbreviation		
Systems Biology B					07-MS-B-121-m01	
Module	coord	inator		Module offered by		
holder	of the C	Chair of Bioinformatics		Faculty of Biology		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Advanc sults fro as regu	es and om fun latory r	current results of compu ctional genomics, dynam networks.	tational systems bio ics of the transcripto	logy are explained a me, of metabolism a	nd discussed, this includes re- Ind metabolic networks as well	
Intende	ed learr	ning outcomes				
Unders <sup>.</sup> ledge o	tand re f typica	cent results in systems b al technologies and resea	iology. Discuss their arch questions of syst	implications. Have a tems biology.	an advanced (Master) level know-	
Courses	<b>s</b> (type,	, number of weekly conta	ct hours, language —	· if other than Germa	n)	
V (no in	Iformat	ion on SWS (weekly cont	act hours) and cours	e language available	2)	
Method ster, inf	<b>l of ass</b> formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
Studen examin each (3	ts will I ation ( o to 6c	be informed about the mo 30 to 60 minutes, includi 9 minutes) or c) oral exam	ethod, length and sco ng multiple choice qu iination in groups of l	ope of the assessme uestions) or b) oral e up to 3 candidates (3	nt prior to the course. a) written xamination of one candidate 30 to 60 minutes)	
Allocat	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPOI (examination regu	lations for teaching-c	legree programmes)		
Module	Module appears in					
Master's degree (1 major) Biology (2011) Master's degree (1 major) Biology (2014) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Biomedicine (2013) Master's degree (1 major) Biomedicine (2012) Master's degree (1 major) Computational Mathematics (2012)						

Module	title				Abbreviation		
Advanced Physical Chemistry c					08-PCM1-102-m01		
Module coordinator Mod				Module offered by			
lecturer copy)	r of sen	ninar "Laserspektroskopi	e" (Laser Spectros-	Institute of Physical	and Theoretical Chemistry		
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)			
10	numei	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semes	ster	graduate					
Conten	ts						
This mo and em tal meth experim knowle	This module introduces students to the fundamental principles of laser spectroscopy. It discusses absorption and emission spectroscopy. In addition, the module gives students the opportunity to use modern experimental methods in physical chemistry in the laboratory. After a safety briefing, the students autonomously conduct experiments in the laboratory. Students will be expected to take tests and write lab reports to demonstrate their knowledge.						
Intende	ed learr	ning outcomes					
Student of laser have de to analy	ts are a techno evelope /se the	ble to explain the compo ology. They are able to de ed a high level of proficie resulting measurements	prents and operating scribe the principles ncy in modern experi and write a lab repo	principles of lasers of absorption and e mental methods in p rt.	as well as the optical principles mission spectroscopy. Students physical chemistry. They are able		
Courses	<b>s</b> (type,	number of weekly conta	ct hours, language –	if other than Germa	n)		
This mo compor • o • o	odule conent. 8-PCM: 8-PCM:	omprises 2 module comp 1-1-102: S + Ü (no informa 1-2-102: P (no information	oonents. Information ation on SWS (weekly n on SWS (weekly co	on courses will be lis contact hours) and ntact hours) and cou	sted separately for each module course language available) rse language available)		
Method ster, inf	<b>l of ass</b> formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
Assessi low. Un vidual a	ment ir less sta assessr	this module comprises ated otherwise, successf nents.	the assessments in t ul completion of the	he individual module module will require s	e components as specified be- successful completion of all indi-		
<ul> <li>Assessment in module component o8-PCM1-1-102: Laser Spectroscopy Laser Spectroscopy</li> <li>5 ECTS, Method of grading: numerical grade</li> <li>written examination (90 minutes) or oral examination (20 minutes)</li> <li>Language of assessment: German or English</li> <li>Assessment in module component o8-PCM1-2-102: Advanced Physical Chemistry (Lab)</li> <li>5 ECTS, Method of grading: (not) successfully completed</li> <li>Vortestate (pre-experiment exams) and Nachtestate (post-experiment exams) (approx. 15 minutes), log (approx. 15 pages)</li> </ul>							
Allocati	ion of n						
Allocal							
 Add:+:-	nalint	rmation					
Auditio	nat mi	Jination					
	- 4						
worklo	aū						
Teachir	ng cycl	9					

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

#### Module appears in

Master's degree (1 major) Chemistry (2010) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module title					Abbreviation	
Chemical Dynamics					08-PCM2-102-m01	
Module	e coord	inator		Module offered by		
lecture mics)	r of sen	ninar "Chemische Dynam	ik" (Chemical Dyna-	Institute of Physical	and Theoretical Chemistry	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	lts					
This mo mics in	odule g 1 more d	ives students the opporti detail. It discusses metho	unity to explore adva ods and models for in	nced topics in chemi vestigating and deso	ical kinetics and reaction dyna- cribing chemical reactions.	
Intende	ed lear	ning outcomes				
Studen thods a	its are a and mo	able to discuss advanced dels for the investigation	topics in chemical k of chemical reaction	inetics and reaction s.	dynamics. They can describe me-	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	if other than Germa	n)	
S + Ü (r	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Methoo ster, in written	d of ass formati examinate of a	<b>cessment</b> (type, scope, la on on whether module ca nation (90 minutes) or ora ssessment: German or Fr	nguage — if other tha an be chosen to earn al examination of one aglish	an German, examina a bonus) e candidate each (20	tion offered — if not every seme- minutes) or talk (30 minutes)	
Allocat	ion of r	places				
	<b>•</b>					
Additio	onal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination regu	lations for teaching-o	legree programmes)		
Module	Module appears in					
Master	's degr	ee (1 major) Chemistry (2	013)			
Master	's degr	ee (1 major) Chemistry (2	010)			
Master	's degr	ee (1 major) Chemistry (2	014)			
Master	's degr	ee (1 major) Mathematics	(2012)	<b>`</b>		
Master	Master's degree (1 major) Computational Mathematics (2012)					

Module title					Abbreviation
Nanoscale Materials					08-PCM3-102-m01
Module	coord	inator		Module offered by	
lecture	of the	seminar "Nanoskalige M	aterialien"	Institute of Physica	l and Theoretical Chemistry
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
This mo	dule d	iscusses advanced topic	s in nanoscale mater	ials. It focuses on th	e structure, properties, fabricati-
on, mo	dern ch	aracterisation methods a	and application areas	s of nanoscale mater	ials.
Intende	ed learn	ning outcomes			
Studen on area	ts are a s of na	ble to characterise nano noscale materials.	scale materials. They	are able to name ar	nalytical methods and applicati-
Course	<b>s</b> (type,	, number of weekly conta	ct hours, language —	if other than Germa	n)
S + Ü (n	infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Method ster, inf written Langua	l of ass formati examir ge of a ion of r	essment (type, scope, la on on whether module ca nation (90 minutes) or ora ssessment: German or Er places	nguage — if other tha an be chosen to earn al examination of one nglish	an German, examina a bonus) e candidate each (20	tion offered — if not every seme- o minutes) or talk (30 minutes)
	<u></u>				
Additio	nal info	ormation			
Worklo	ad				
Teachir	ng cycl	9			
	3 - )	-			
Referre	d to in	<b>LPO I</b> (examination regu	lations for teaching-o	legree programmes)	
Module	appea	irs in			
Bachelo	or' degi	ree (1 major) Nanostructu	re Technology (2010)	)	
Bachelo	or' degi	ree (1 major) Nanostructu	re Technology (2012)	)	
Master'	s degre	ee (1 major) Chemistry (20	013)		
Master'	s degre	ee (1 major) Chemistry (2	010)		
Master'	s degre	ee (1 major) Chemistry (2	014)		
Master'	s degre	ee (1 major) Mathematics	(2012)		
Master'	s degre	ee (1 major) Computation	al Mathematics (201	2)	
Master'	Master's degree (1 major) Functional Materials (2012)				

Module title					Abbreviation
Ultrafast spectroscopy and quantum-control					08-PCM4-102-m01
Module	coord	inator		Module offered by	
lecturei Quante	r of the nkontr	seminar "Ultrakurzzeitsp olle"	ektroskopie and	Institute of Physical	and Theoretical Chemistry
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
This mo laser pu	odule d ulses, t	iscusses advanced topic ime-resolved laser spect	s in ultrafast spectro roscopy and coheren	scopy and quantum t control.	control. It focuses on ultrashort
Intende	ed learı	ning outcomes			
Studen plain th principl	ts are a le theo les and	able to describe the gene ry of time-resolved laser applications of quantum	ration of ultrashort la spectroscopy and na n control.	ser pulses and to ch me experimental me	aracterise them. They can ex- thods. They can describe the
Courses	<b>s</b> (type	, number of weekly conta	ct hours, language –	· if other than Germa	n)
S + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Methoo ster, inf	<b>l of ass</b> formati	s <b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
written Langua	examiı ge of a	nation (90 minutes) or or ssessment: German or Er	al examination of one	e candidate each (20	minutes) or talk (30 minutes)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad		-		
Teachir	ng cycl	e			
Referre	d to in	LPOI (examination regu	lations for teaching-o	legree programmes)	
Module	appea	ars in			
Master'	s degr	ee (1 major) Chemistry (2	010)		
Master'	s degr	ee (1 major) Mathematics	(2012)		
Master's degree (1 major) Computational Mathematics (2012)					

Module title				Abbreviation		
Physical chemistry of supramolecular assemblies					08-PCM5-102-m01	
Module	e coord	inator		Module offered by		
lecture kularer	r of the Strukti	seminar "Physikalische ( uren"	Chemie Supramole-	Institute of Physical	l and Theoretical Chemistry	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
This mo	odule e perties	xamines the basic intera of aggregates as well as	ctions between mole key applications of s	cules. It discusses th upramolecular chem	ne formation and physical-chemi- istry.	
Intende	ed leari	ning outcomes				
Studen in the f dern ap	ts are a ield. Th oplicati	able to explain the basic i ley can describe the form ons of supramolecular ch	interactions between ation and physical-cl nemistry.	molecules demonst nemical properties o	rating a high degree of expertise f aggregates. They can name mo-	
	s (type	mation on SWS (wooldwa	ct nours, tanguage –			
5 + U (r		mation on SWS (weekly o				
ster in	<b>d of ass</b> formati	s <b>essment</b> (type, scope, la on on whether module ca	nguage — if other the	an German, examina a bonus)	tion offered — if not every seme-	
written minute Langua	examin s) ge of a	nation (90 minutes) and/ ssessment: German or Er	or oral examination o	of one candidate eac	h (20 minutes) and/or talk (30	
Allocat	ion of r	places				
Additio	nal inf	ormation				
Worklo						
WORKIO	<u>au</u>					
		-				
Teachi		e				
Referre	a to in	LPOI (examination regu	lations for teaching-o	legree programmes)		
Module	e appea	irs in				
Master	's degre	ee (1 major) Chemistry (2)	013)			
Master	s aegro	ee (1 major) Chemistry (2 20 (1 major) Mathematics	U10) (2012)			
Master	s uegn 's degri	ee (1 major) Mathematics	o (2012) of Functional Material	5 (2010)		
Master	's degr	ee (1 major) Technology c	of Functional Material	s (2009)		
Master	's degr	ee (1 major) Computation	al Mathematics (201	2)		
Master	Master's degree (1 major) Functional Materials (2012)					

Module title					Abbreviation	
Physical Chemistry (Advanced Lab)       08-PCM6-102-m01						
Module	e coord	inator		Module offered by		
lecture	rs Phys	ikalische Chemie (Physic	al Chemistry)	Institute of Physical	and Theoretical Chemistry	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
This mo the Inst	odule g titute o	ives students the opport f Physical Chemistry and	unity to get involved i learn some advanced	n the work of one of d synthesis and anal	the research groups based at ytical methods.	
Intende	ed learı	ning outcomes				
Studen arch gr	ts have oup. Th	e become proficient in the ley are able to analyse th	e research methods ty eir findings and thus	pically used by the help answer topical	relevant physical chemistry rese- questions in physical chemistry.	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
P (no in	format	ion on SWS (weekly cont	act hours) and course	e language available	)	
Methoo ster, in	<b>l of ass</b> formati	s <b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
present Langua	tation ( ge of a	20 minutes) ssessment: German or Er	nglish			
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPOI (examination regu	lations for teaching-c	legree programmes)		
Module	Module appears in					
Master	's degr	ee (1 major) Chemistry (2	010)			
Master	's degr	ee (1 major) Mathematics	(2012)			
Master	Master's degree (1 major) Computational Mathematics (2012)					

(2012)

Module title					Abbreviation	
Theoretical Chemistry - Project work         08-TCAP-102-m01						
Module coordinator			Module offered by			
head o	of the re	search group offering the	e module	Institute of Physica	l and Theoretical Che	emistry
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		,
10	(not) s	successfully completed		• • • •		
Durati	on	Module level	Other prerequisites			
1 seme	ester	graduate				
Conte	nts					
This m the Ins	odule g stitute o	ives students the opport f Theoretical Chemistry a	unity to get involved nd learn some of the	in the work of one of methods typically u	the research groups sed in the discipline	s based at
Intend	ed lear	ning outcomes				
Stude sues t	nts have hat are	e learned some of the me relevant to the fields cove	thods typically used ered.	in theoretical chemis	stry. They are able to	explain is-
Course	es (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
This m	odule h	as 3 components: inform	nation on courses list	ed separately for eac	ch component.	
•	08-TCAF	P-1-102: P (no information	on language and nu	mber of weekly cont	act hours available)	
•	08-TCAF	P-2-102: P (no information	n on language and nu	Imber of weekly cont	act hours available)	
•	08-TCAF	P-3-102: P (no information	n on language and nu	imber of weekly cont	act hours available)	
Metho ster, ir	o <b>d of ass</b> nformati	s <b>essment</b> (type, scope, la on on whether module ca	inguage — if other th an be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
This m	odule h	as the following 3 assess	sment components. ]	o pass the module a	is a whole students i	must pass
two ou	it of the	se three assessment con	iponents.			
Δεερε	smont c	omponent to module cor	nnonent o8-TCAP-1-1	<b>nz.</b> Theoretische Ch	emie Arheitsgrunner	nraktikum
Weller	npaketd	ynamik				ipiuktikum
•	5 ECTS o	redits, method of gradin	g: (not) successfully	completed		
•	present	ation (approx. 30 minute	s) 			
Δςςρς	Languas Sment c	ge of assessment: Germa	n or Englisn nnonent o8-TCAP-2-4	<b>102.</b> Theoretische Ch	emie Arheitsgrunne	nnraktikum
Weller	funktio	nsmethoden			enne Albentsgrupper	ipiakiikuiii
•	5 ECTS o	redits, method of gradin	g: (not) successfully	completed		
•	present	ation (approx. 30 minute	s)			
Δςςρς	Languas Sment c	ge of assessment: Germa	n or Englisn nnonent o8-TCAP-2-4	<b>102.</b> Theoretische Ch	emie Arheitsgrunner	nnraktikum
Dichte	funktio	naltheorie			ennevirbensgrupper	ipiantinum
•	5 ECTS o	redits, method of gradin	g: (not) successfully	completed		
•	present	ation (approx. 30 minute	S) n ar Englich			
Alloca	tion of					
Alloca		Jaces				
Additi	onal inf	ormation				
Additi	onal info	ormation on module dura	ition: 4 weeks			
Workl	oad					
Teaching cycle						
Referr	ed to in	LPOI (examination regu	lations for teaching-	degree programmes)		
Master's v (2012)	vith 1 majo	Computational Mathematics	JMU Würzburg • ge cord Master (120	enerated 26-Aug-2024 • exam ECTS) Computational Mather	n. reg. data re- natics - 2012	page 24 / 172

#### Module appears in

Master's degree (1 major) Chemistry (2010) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Computational Mathematics (2012)

Module title					Abbreviation	
Theoretical Chemistry					08-TCM1-102-m01	
Module	coord	inator		Module offered by		
lecture	r of lect	ture "Theoretische Chemi	e"	Institute of Physica	l and Theoretical Chemistry	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Admission prerequis	site to assessment: s	successful completion of exerci-	
			ses in the respective	e classes as specifie	d at the beginning of the course	
			(usually 70% of exer	cises to be successf	fully completed) as well as regu-	
			lar attendance of ex	ercises (usually a ma	aximum of 2 incidents of unexcu-	
Conton	te		sed absence).			
This me	udulo ir	atroducos students to the	fundamental princir	los of theoretical ch	omistry	
Intende	d lear	ning outcomes			ennstry.	
Studen	ts are a	able to describe the math	ematical and physics	al principles underly	ing the quantum chemical and	
quantu	m dyna	amical approaches of the	oretical chemistry.		ing the quantum chemical and	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	· if other than Germa	n)	
S + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methoo ster, inf	<b>l of ass</b> formati	s <b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written Langua	examii ge of a	nation (90 minutes) ssessment: German or Er	nglish			
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPOI (examination regu	lations for teaching-c	legree programmes)		
Module	e appea	ars in				
Master'	s degr	ee (1 major) Chemistry (2	010)			
Master'	s degr	ee (1 major) Mathematics	(2012)			
Master'	s degr	ee (1 major) Mathematics	(2010)	<b>`</b>		
Master'	s degr	ee (1 major) Computation	al Mathematics (201	2)		
Master'	Master's degree (1 major) FOKUS Pharmacy (2012)					

Module title					Abbreviation	
Computational Chemistry					08-TCM2-102-m01	
Module	coord	inator		Module offered by		
lecturer	of lect	ure "Computational Cher	nistry"	Institute of Physica	l and Theoretical Chemistry	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate	Admission prerequisite to assessment: successful completion of exerci- ses in the respective classes as specified at the beginning of the course (usually 70% of exercises to be successfully completed) as well as regu- lar attendance of exercises (usually a maximum of 2 incidents of unexcu- sed absence).			
Conten	ts					
This mo	odule ir	ntroduces students to the	e fundamental princip	oles of computationa	al chemistry.	
Intende	ed leari	ning outcomes				
Student putation	ts are a nal che	ble to explain the theore mistry.	tical principles of co	nputational chemist	ry and to apply methods in com-	
Courses	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
S + Ü (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
<b>Method</b> ster, inf	<b>l of ass</b> formati	e <b>ssment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written Langua	examiı ge of a	nation (90 minutes) ssessment: German or Er	nglish			
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachin	ng cycl	9				
Referre	d to in	LPOI (examination regu	lations for teaching-c	legree programmes)		
Module	appea	rs in				
Master'	s degr	ee (1 major) Chemistry (20	010)			
Master'	s degr	ee (1 major) Mathematics	(2012)			
Master'	s degr	ee (1 major) Mathematics	(2010)	<b>`</b>		
Master'	Master's degree (1 major) Computational Mathematics (2012)					

Module	Module title Abbreviation					
Progra	mming	in Theoretical Chemistry			08-TCM3-102-m01	
Module coordinator				Module offered by		
lecture mie"	r of lect	ture "Programmieren in T	heoretischer Che-	Institute of Physical	and Theoretical Chemistry	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
This mo ses its	odule p applica	rovides an introduction t ition areas.	o the fundamentals o	of programming in th	eoretical chemistry and discus-	
Intend	ed learı	ning outcomes				
Studen as well	its are a as to n	able to explain and use o ame its application areas	ne of the programmir s.	ng languages typicall	y used in theoretical chemistry	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
S + Ü (I	no infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Metho ster, in	<b>d of ass</b> formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
comple Langua	etion ar age of a	d discussion of approx. ssessment: German or Er	5 programming exerc nglish	ises as well as talk (a	approx. 45 minutes)	
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Teachi	ng cycl	6				
Referre	ed to in	LPOI (examination regu	lations for teaching-o	degree programmes)		
Module appears in						
Master's degree (1 major) Chemistry (2013)						
Master's degree (1 major) Chemistry (2010)						
Master's degree (1 major) Chemistry (2014)						
Master	's degr	ee (1 major) Mathematics	(2012)			
Master	's aegro	ee (1 major) Mathematics	al Mathematics (and	2)		
master	s uego		at mathematics (201	2)		

Module title					Abbreviation
Advanced Automation					10-I=AA-102-m01
Module coordinator				Module offered by	
holder	of the (	Chair of Computer Scienc	e VII	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-
			ning of the course (e	e.g. completion of ex	xercises).
Conten	ts				
Advanc the fiel	ed top d of se	ics in automation system nsor data processing, act	s as well as instrume uators, cooperating s	ntation and control operation and control op	engineering, for example from d trajectory planning.
Intende	ed lear	ning outcomes			
The stu ment a	dents l dvance	nave an advanced knowle d automation systems.	edge of selected topic	cs in automation sys	tems. They are able to imple-
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)
Method	l of ass	essment (type, scope, la	nguage — if other tha	an German, examina	tion offered — if not every seme-
ster, in	formati	on on whether module ca	an be chosen to earn	a bonus)	····,···,
written tion dat aminati tion of examin Langua	examin te, the ion in g one can ation in ge of a	nation (approx. 80 to 90 f written examination can groups. A 80 to 90 minute ndidate each, a 30 minut n groups of 3. ssessment: German, Eng	minutes). If announce be replaced by an ora e written examination e (approx.) oral exam lish if agreed upon w	ed by the lecturer by al examination of on- is equivalent to a 20 ination in groups of ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- o minute (approx.) oral examina- 2 and a 40 minute (approx.) oral
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
Master's degree (1 major) Computer Science (2010)					
Master	s degr	ee (1 major) Mathematics	(2012)		
Master	s degr	ee (1 major) Mathematics	(2010)		
Master's degree (1 major) Computational Mathematics (2012)					

Module	Module title Abbreviation					
Compu	Computational Geometry 10-I=AG-102-m01					
Module	e coord	inator		Module offered by		
holder	of the (	Chair of Computer Scienc	e l	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
			ning of the course (e	e.g. completion of ex	kercises).	
Conten	ts					
In man formati algorith gorithm ve.	y areas on syst nmic as ns and	of computer science fo tems it is necessary to s pects of these tasks: We data structures. Every teo	or example robotics, o store, analyse, create will acquire techniqu chnique will be illustr	computer graphics, v or manipulate spati ues that are needed ated with a problem	virtual reality and geographic in- al data. This class is about the to plan and analyse geometric al- in the practical areas listed abo-	
Intende	ed lear	ning outcomes				
The stu metric based o	idents probler on the	are able to decide which n. The students are able concepts and techniques	algorithms or data st to analyse new probl acquired in the lectu	ructures are suitable ems and to come up ıre.	for the solution of a given geo- with their own efficient solutions	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
V + Ü (r	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Method ster, in	<b>d of ass</b> formati	<b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written tion da aminat Langua	examin te, the ion in g ge of a	nation (approx. 50 to 60 r written examination can groups (one candidate ea ssessment: German, Eng	ninutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)	
Allocat	ion of <b>j</b>	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Master	's degr	ee (1 major) Computer Sc	ience (2010)			
Master's degree (1 major) Mathematics (2012)						
Master	's degr	ee (1 major) Mathematics	(2010)			
Master	's degr	ee (1 major) Computation	al Mathematics (201	2)	,	
First state examination for the teaching degree Gymnasium Computer Science (2009)						

Module title					Abbreviation	
Algorithms for Geographic Information Systems			i Systems		10-I=AGIS-102-m01	
Module	coord	inator		Module offered by		
holder	of the C	Chair of Computer Scienc	e l	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
			ning of the course (e	e.g. completion of ex	kercises).	
Conten	ts					
Algorith sition, p misatio tial plar	nmic fo process n. App nning a	undations of geographic sing, analysis and presen lications such as the crea is well as cartographic ge	information systems atation of spatial infor ation of digital height eneralisation.	and their applicatio mation. Processes o models, working wi	n in selected problems of acqui- of discrete and continuous opti- th GPS trajectories, tasks of spa-	
Intende	ed learn	ning outcomes				
The stu to selec	dents a t and i	are able to formalise algo mprove suitable approac	rithmic problems in t hes to solving these	he field of geograph problems.	ic information systems as well as	
Courses	<b>s</b> (type,	, number of weekly conta	ct hours, language —	if other than Germa	n)	
V + Ü (n	infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)	
Method ster, inf	<b>l of ass</b> formati	e <b>ssment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written tion dat aminati Langua	examin te, the ion in g ge of a	nation (approx. 50 to 60 r written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)	
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
Teachir	Teaching cycle					
<b>Paferred to in LPO L</b> (examination regulations for teaching degree programmes)						
Module appears in						
Master'	Master's degree (1 major) Computer Science (2010)					
Master'	Master's degree (1 major) Mathematics (2012)					
Master'	Master's degree (1 major) Mathematics (2010)					
Master'	s degre	ee (1 major) Computation	al Mathematics (2012	2)		
First sta	First state examination for the teaching degree Gymnasium Computer Science (2009)					

Module title					Abbreviation	
Approx	Approximation Algorithms 10-I=APA-102-m01					
Module coordinator				Module offered by		
holder	ofthe	Chair of Computer Scienc	e l	Institute of Comput	er Science	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
			ning of the course (e	e.g. completion of ex	kercises).	
Conten	ts					
The tas	sk of fir	iding the optimal solution	n for a given problem	is omnipresent in co	mputer science. Unfortunately,	
there a	re man	y problems without an ef	ficient algorithm for a	an optimal solution.	As a result, in practice, methods	
draftin	a whice and a	in do not always give the	optimal solution but	always give good so	ation quality. With the help of	
practic	al optir	nisation problems, the le	cture will introduce s	tudents to importan	t drafting techniques such as	
greedy	, local s	search, scaling as well as	methods based on l	inear programming.		
Intend	ed lear	ning outcomes				
The stu	Idents	are able to analyse easy a	approximation metho	ods in terms of their o	quality. They understand fun-	
damen	tal drai	fting techniques such as	greedy, local search a	and scaling as well a	s methods based on linear pro-	
gramm	ing and	d are able to apply these	to new problems.			
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
V + Ü (I	no info	rmation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Metho ster, in	<b>d of as</b> format	s <b>essment</b> (type, scope, la ion on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written tion da aminat Langua	exami te, the ion in g age of a	nation (approx. 50 to 60 i written examination can groups (one candidate ea issessment: German, Eng	minutes); if announco be replaced by an ora ch: 15 minutes, grouj ¦lish if agreed upon w	ed by the lecturer by al examination of on ps of 2: 20 minutes, vith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)	
Allocat	ion of	places				
Additio	onal inf	ormation				
Worklo	ad					
Teaching cycle						
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Master	's degr	ee (1 major) Computer Sc	ience (2010)			
Master's degree (1 major) Mathematics (2012)						
Master	's degr	ee (1 major) Mathematics	5 (2010)			
Master	's degr	ee (1 major) Computation	al Mathematics (201	2)		
First state examination for the teaching degree Gymnasium Computer Science (2009)						

Module title					Abbreviation
Automata Theory					10-I=AUT-102-m01
Module	e coord	inator		Module offered by	
Dean o	f Studie	es Informatik (Computer S	Science)	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Admission prerequis	site to assessment: e	exercises (type and scope to be
			announced by the le	ecturer at the beginn	ing of the course).
Conten	ts				
Finite a words, on of re	utomat langua egular la	ta, regular languages, sta ge acceptance through m anguages and star-free la	rr-free languages, nat nonoids, syntactic mo Inguages, two-way at	ural equivalence rela onoid, predicate logi utomata.	ations, predicate logic with cal and algebraic characterisati-
Intende	ed learr	ning outcomes			
The stu ges, sta monoic two-wa	dents p ar-free l ls, synt y autor	possess a fundamental a languages, natural equiva actic monoid, predicate l nata.	nd applicable knowle alence relations, prec ogical and algebraic	edge in the areas of f licate logic with word characterisation of r	inite automata, regular langua- ds, language acceptance through egular and star-free languages,
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Method ster, in	<b>l of ass</b> formati	<b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
written tion da aminat Langua	examir te, the ion in g ge of a	nation (approx. 50 to 60 r written examination can groups (one candidate ea ssessment: German, Eng	ninutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
Master	's degre	ee (1 major) Mathematics	(2012)		
Master	's degre	ee (1 major) Computation	al Mathematics (201	2)	
First state examination for the teaching degree Gymnasium Computer Science (2009)					

Module title					Abbreviation
Computability Theory					10-l=BER-102-m01
Module coordinator				Module offered by	
Dean of	fStudi	es Informatik (Computer S	Science)	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Admission prerequis	site to assessment: e	exercises (type and scope to be
			announced by the le	ecturer at the beginn	ing of the course).
Conten	ts				
Gödel r and pro	umbeı ductiv	ring, computable functior e sets, relative computab	ns, decidable and cou pility, Turing reduction	untable sets, halting n, countable degrees	problem, m-reducibility, creative s, arithmetic hierarchy.
Intende	ed lear	ning outcomes			
The stu ons, de tability,	dents   cidable , Turing	possess a fundamental a e and countable sets, hal g reduction, countable de	nd applicable knowle lting problem, m-redu grees, arithmetic hie	edge in the areas of ( acibility, creative and rarchy.	Gödel numbers, countable functi- l productive sets, relative compu-
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Methoo ster, inf	<b>l of ass</b> formati	<b>sessment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
written tion dat aminat Langua	examii te, the ion in ទួ ge of a	nation (approx. 50 to 60 r written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Master's degree (1 major) Mathematics (2012)					
Master	Master's degree (1 major) Computational Mathematics (2012)				
First sta	ate exa	mination for the teaching	g degree Gymnasium	Computer Science (2	2009)

Module title					Abbreviation	
Compiler Construction					10-l=CB-102-m01	
Module	e coord	inator		Module offered by		
holder	of the (	Chair of Computer Scienc	e ll	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
			ning of the course (e	e.g. completion of ex	xercises).	
Conten	ts					
Lexical	analys	is, syntactic analysis, sei	mantics, compiler ger	nerators, code gener	ators, code optimisation.	
Intende	ed leari	ning outcomes				
The stu They ar and co	dents j e able mpiler ;	bossess knowledge in the to perform transformatio generators.	e formal description on ns between them with	of programming lang n the help of finite au	uages and their compilation. utomata, push-down automata	
Course	<b>s</b> (type	, number of weekly conta	ict hours, language —	if other than Germa	n)	
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)	
Methor ster, in	<b>d of ass</b> formati	essment (type, scope, la on on whether module ca	inguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
tion da aminat tion of examin Langua	te, the ion in g one can ation in ge of a	written examination can groups. A 80 to 90 minute ndidate each, a 30 minut n groups of 3. ssessment: German, Eng	be replaced by an ora written examination e (approx.) oral exam	al examination of on is equivalent to a 20 ination in groups of ith the examiner	e candidate each or an oral ex- o minute (approx.) oral examina- 2 and a 40 minute (approx.) oral	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Computer Science (2010)						
Master	Master's degree (1 major) Computer Science (2010) Master's degree (1 major) Mathematics (2012)					
Master	's degr	ee (1 major) Mathematics	5 (2010)			
Master	's degr	ee (1 major) Computation	al Mathematics (201	2)		
First sta	ate exa	mination for the teaching	g degree Gymnasium	Computer Science (2	2009)	

Module title					Abbreviation	
Databases II					10-l=DB2-102-m01	
Module	coord	inator		Module offered by		
Dean of	Studi	es Informatik (Computer	Science)	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
			ning of the course (e	.g. completion of ex	xercises).	
Content	ts					
Data wa	arehou	ses and data mining; XM	L databases; web dat	abases;introductior	n to Datalog.	
Intende	d lear	ning outcomes				
The stu	dents	have advanced knowledg	e about relational da	tabases, XML and d	ata mining.	
Courses	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
V + Ü (n	infoi	mation on SWS (weekly o	contact hours) and co	urse language avail	able)	
Method ster, inf	l of ass ormati	sessment (type, scope, la ion on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written tion dat aminati Langua	examinate, the on in g ge of a	nation (approx. 50 to 60 n written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)	
Allocati	ion of <b>j</b>	olaces				
Additio	nal inf	ormation				
Workloa	ad					
Teachin	ig cycl	e				
	<u> </u>					
Referre	d to in	LPO I (examination regu	lations for teaching-c	legree programmes)		
Module	annea	ars in				
Master'	s degr	ee (1 maior) Computer Sc	ience (2010)			
Master'	s degr	ee (1 major) Mathematics	5 (2012)			
Master'	Master's degree (1 major) Mathematics (2012)					
Master'	Master's degree (1 major) Physics (2010)					
Master'	Master's degree (1 major) Physics (2011)					
Master'	Master's degree (1 major) Nanostructure Technology (2011)					
Master'	Master's degree (1 major) Nanostructure Technology (2010)					
Master'	Master's degree (1 major) Business Information Systems (2011)					
Master'	s degr	ee (1 major) Business Info	ormation Systems (20	)13)		
Master'	s degr	ee (1 major) Computation	al Mathematics (201	2)		
First sta	s uegr	ee (1 major) Functional M	alenais (2012) r degree Gympacium	Computer Science (c	2000)	
11151 510		וווועמטו זטו נוופ נכמנווווע	successive oynnasiulli		2009)	
Module	Module title Abbreviation					
--	--	--	--	---	---	--
Deductive Databases					10-l=DDB-102-m01	
Modulo coordinator				Modulo offered by		
Deen	E Ctudi	IIIdlui	Science)	Institute of Comput		
	Mothe	es informatik (Computer :	Science)	institute of Comput		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
		3	ning of the course (e	. g. completion of ex	xercises).	
Conten	ts		<u> </u>	<u> </u>		
Syntax	and se	mantics of logic program	s: data structures pr	ogram structures an	d applications for Prolog- analyti-	
cal met	hods fo	or Datalog; negation and	stratification; disjund	ctive logic programs.		
Intende	ed learı	ning outcomes				
The stu	dents p	oossess expertise in worl	king with Prolog and I	Datalog (including n	egation and disjunction).	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	in)	
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)	
Method	l of ass	<b>essment</b> (type, scope, la	nguage — if other tha	an German, examina	tion offered — if not every seme-	
ster, inf	formati	on on whether module ca	an be chosen to earn	a bonus)		
tion dat aminati tion of examin Langua	te, the ion in g one car ation in ge of a	written examination can groups. A 80 to 90 minute ndidate each, a 30 minut n groups of 3. ssessment: German, Eng	be replaced by an ora written examination e (approx.) oral exam lish if agreed upon w	al examination of on is equivalent to a 20 ination in groups of ith the examiner	e candidate each or an oral ex- o minute (approx.) oral examina- 2 and a 40 minute (approx.) oral	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in						
Master'	s degr	ee (1 major) Computer Sc	ience (2010)			
Master'	s degr	ee (1 major) Mathematics	(2012)			
Master'	s degr	ee (1 major) Mathematics	(2010)	,		
Master'	s degr	ee (1 major) Computation	al Mathematics (201	2)	、 、	
First sta	ate exa	mination for the teaching	g degree Gymnasium	Computer Science (2	2009)	

Module title			Abbreviation				
E-Learning				10-I=EL-102-m01			
Module	coord	inator		Module offered by			
holder	of the (	Chair of Computer Scienc	e VI	Institute of Comput	er Science		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
5	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semes	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-		
			ning of the course (e	e.g. completion of ex	kercises).		
Content	ts						
Learnin intellige stems.	g para ent tuto adapti	digms, learning system ty pring systems, student m ve tutoring systems, com	/pes, author systems, odels, didactics, prob puter-supported coor	, learning platforms, plem-oriented learni perative learning, ev	standards for learning systems, ng and case-based training sy- aluation of learning systems.		
Intende	d lear	ning outcomes	<u></u>	0, 11	8 . ,		
The stu	donte	nossess a theoretical and	I practical knowledge	about el earning an	d are able to assess possible an-		
plicatio	ns.				d are able to assess hossible ap-		
Courses	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)		
V + Ü (n	io infoi	mation on SWS (weekly o	contact hours) and co	urse language avail	able)		
Method ster, inf	<b>l of ass</b> ormati	<b>sessment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
written tion dat aminati Langua	examine, the on in g ge of a	nation (approx. 50 to 60 r written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)		
Allocati	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
	uu						
Teachin	ig cvcl	e					
	0	-					
Referre	d to in	LPOI (examination regu	lations for teaching-d	legree programmes)			
Module appears in							
Master's degree (1 major) Computer Science (2010)							
Master'	s degr	ee (1 major) Mathematics	(2012)				
Master'	Master's degree (1 major) Mathematics (2010)						
Master'	s degr	ee (1 major) Business Info	ormation Systems (20	011)			
Master'	s degr	ee (1 major) Business Info	ormation Systems (20	)13)			
Master'	s degr	ee (1 major) Computation	al Mathematics (2012	2)			
Master'	s degr	ee (1 major) Functional M	aterials (2012)	Commuter Colored (			
FIRST STA	ite exa	mination for the teaching	, degree Gymnasium	computer Science (2	2009)		

Module title				Abbreviation	
Embed	Embedded Systems 10-I=ES-102-m01				
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Informatik (Computer S	Science)	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
8	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-
			ning of the course (e	e.g. completion of ex	kercises).
Conten	ts				
Models system re synt	s of em s, impl hesis.	bedded systems, implem ementation planning stat	entation methods (A tic, periodic and dyna	SIC, AISIP, micro con amic, binding proble	troller), verification of embedded ms, hardware synthesis, softwa-
Intend	ed lear	ning outcomes			
The stu most ir softwa	idents a nportar re.	are familiar with the tech nt techniques for the moc	nical possibilities for lelling, verification ar	the design of embed nd optimisation of su	dded systems and master the uch systems in hardware and
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	· if other than Germa	n)
V + Ü (ı	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Metho ster, in	<b>d of ass</b> formati	<b>sessment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
written tion da aminat tion of examir Langua	examin te, the ion in g one can ation in age of a	nation (approx. 80 to 90 f written examination can groups. A 80 to 90 minute ndidate each, a 30 minut n groups of 3. ssessment: German, Eng	minutes). If announce be replaced by an ora e written examination e (approx.) oral exam lish if agreed upon w	ed by the lecturer by al examination of one is equivalent to a 20 ination in groups of ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- o minute (approx.) oral examina- 2 and a 40 minute (approx.) oral
Allocat	ion of p	olaces	·		
Additio	nal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
Master	's degr	ee (1 major) Computer Sc	ience (2010)		
Master	's degr	ee (1 major) Mathematics	(2012)		
Master	's degr	ee (1 major) Mathematics	(2010)		
Master	's degr	ee (1 major) Computation	al Mathematics (201	2)	
First st	ate exa	mination for the teaching	aegree Gymnasium	Computer Science (2	2009)

Module title				Abbreviation		
Cryptography and Data Security			10-l=KD-102-m01			
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Informatik (Computer S	Science)	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
			ning of the course (e	e.g. completion of ex	kercises).	
Conten	ts					
Private RSA, Di	key cry iffie-He	ptography systems, Vern Ilman, Elgamal, Goldwas	iam one-time pad, AE ser-Micali, digital sig	S, perfect security, p nature, challenge-re	oublic key cryptography systems, sponse methods, secret sharing,	
million	aire pro	blem, secure circuit eval	uation, homomorpho	ous encryption.		
Intende	ed lear	ning outcomes				
The stu stems, wasser evaluat	Idents   Vernar -Micali tion, ho	possess a fundamental a n one-time pad, AES, per , digital signature, challe momorphous encryption	nd applicable knowle fect security, public k nge-response methoo	edge in the areas of p ey cryptography, RS d, secret sharing, mi	private key cryptography sy- A, Diffie-Hellman, Elgamal, Gold- llionaire problem, secure circuit	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
V + Ü (r	no infoi	mation on SWS (weekly o	contact hours) and co	urse language avail	able)	
Metho ster, in	<b>d of ass</b> formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written tion da aminat Langua	examin te, the ion in g ige of a	nation (approx. 50 to 60 r written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachi		0				
Teacini	ig cyci	5				
<b>Referred to in LPUT</b> (examination regulations for teaching-degree programmes)						
Mastor	's dogr	n s m 20 (1 maior) Computer Sc	ionco (2010)			
Master	's degr	ee (1 major) Computer Sc	(2012)			
Master	's degr	ee (1 major) Mathematics	(2010)			
Master	's degr	ee (1 major) Computation	al Mathematics (2012	2)		
First sta	ate exa	mination for the teaching	g degree Gymnasium	Computer Science (2	2009)	

Module title				Abbreviation		
Artifici	Artificial Intelligence 10-I=KI-102-m01					
Module coordinator				Module offered by		
holder	of the (	Chair of Computer Scienc	e VI	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
			ning of the course (e	e.g. completion of ex	xercises).	
Conter	Its					
Intellig	ent age	ents, uninformed and heu	ristic search, constra	aint problem solving,	search with partial information,	
propos	itional	and predicate logic and i	nference, knowledge	representation, plan	nning, probabilistic closure and	
Bayesi	an netv	vorks, utility theory and d	ecidability problems	, learning from obse	rvations, knowledge while lear-	
ning, n	eural n	etworks and statistical le	arning methods, rein	forcement learning.		
Intend	ed lear	ning outcomes				
The stu possib	idents   ilities fo	possess theoretical and p or its application.	oractical knowledge a	about artificial intelli	gence and are able to assess	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	- if other than Germa	n)	
V + Ü (	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Metho	d of ass	sessment (type, scope, la	nguage — if other tha	an German, examina	tion offered — if not every seme-	
ster, in	formati	on on whether module ca	an be chosen to earn	a bonus)		
written	exami	nation (approx. 80 to 90 i	minutes); if announc	ed by the lecturer by	four weeks prior to the examina-	
tion da	te, the	written examination can	be replaced by an ora	al examination of on	e candidate each or an oral ex-	
aminat	ion in g	groups (one candidate ea	ch: 15 minutes, group	os of 2: 20 minutes,	groups of 3: 25 minutes)	
Langua	age of a	ssessment: German, Eng	lish if agreed upon w	ith the examiner		
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination regu	lations for teaching-o	degree programmes)		
	-					
Module appears in						
Master's degree (1 major) Computer Science (2010)						
Master's degree (1 major) Mathematics (2012)						
Master's degree (1 major) Mathematics (2010)						
Master	Master's degree (1 major) Physics (2010)					
Master	's degr	ee (1 major) Physics (201	1)			
Master	's degr	ee (1 major) Nanostructur	re Technology (2011)			
Master	's degr	ee (1 major) Nanostructur	re Technology (2010)			
Master	's degr	ee (1 major) Computation	al Mathematics (201	2)		
First st	ate exa	mination for the teaching	degree Gymnasium	Computer Science (2	2009)	

Module title				Abbreviation		
Advanc	ed Top	ics in Computational Cor	nplexity		10-l=KT2-102-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Informatik (Computer	Science)	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
			ning of the course (e	e.g. completion of ex	xercises).	
Conten	ts					
Propert ty of pr	ties of I obabili	NP-complete sets, autore stic algorithms.	ducibility, interactive	proof systems, poly	nomial time hierarchy, complexi-	
Intende	ed lear	ning outcomes				
The stu autored	idents   ducibili	possess a fundamental a ty, interactive proof syste	nd applicable knowle ems, polynomial time	edge in the areas of hierarchies, comple	properties of NP-complete sets, exity of probabilistic algorithms.	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	· if other than Germa	n)	
V + Ü (r	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Metho ster, in	<b>d of ass</b> formati	<b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written tion da aminat tion of examin Langua	examin te, the ion in g one can nation in age of a	nation (approx. 80 to 90 written examination can groups. A 80 to 90 minute ndidate each, a 30 minut n groups of 3. ssessment: German, Eng	minutes). If announce be replaced by an ora e written examination e (approx.) oral exam lish if agreed upon w	ed by the lecturer by al examination of on- is equivalent to a 20 ination in groups of ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- o minute (approx.) oral examina- 2 and a 40 minute (approx.) oral	
Allocat	ion of p	olaces				
	_					
Additio	nal inf	ormation				
Worklo	ad					
<b>Referred to in LPO L</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Master	Master's degree (1 major) Computer Science (2010)					
Master	's degr	ee (1 major) Mathematics	5 (2010)			
Master	's degr	ee (1 major) Computation	al Mathematics (201	2)		

Module title	Abbreviation					
Medical Informatics			10-I=MI-102-m01			
Module coordinator		Module offered by				
holder of the Chair of Computer Scie	nce VI	Institute of Comput	er Science			
ECTS Method of grading	Only after succ. con	pl. of module(s)				
5 numerical grade						
Duration Module level	Other prerequisites					
1 semester graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-			
	ning of the course (e	e.g. completion of ex	kercises).			
Contents						
Electronic patient folder, coding of n mary and functional units, medical c cal research, case-based training sys	nedical data, hospital ir lecision making and as stems in medical trainir	formation systems, sistance systems, sta ng.	operation of computers in infir- atistics and data mining in medi-			
Intended learning outcomes						
The students possess theoretical an medicine.	d practical knowledge a	about the applicatior	n of computer science methods in			
Courses (type, number of weekly cor	ntact hours, language –	- if other than Germa	n)			
V + Ü (no information on SWS (week	ly contact hours) and co	ourse language avail	able)			
Method of assessment (type, scope, ster, information on whether module	language — if other that can be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-			
written examination (approx. 50 to 6 tion date, the written examination ca amination in groups (one candidate Language of assessment: German, E	o minutes); if announce in be replaced by an ora each: 15 minutes, grou nglish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)			
Allocation of places						
Additional information						
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Computer	Science (2010)					
Master's degree (1 major) Mathemat	ics (2012)					
Master's degree (1 major) Mathemat	ics (2010)					
Master's degree (1 major) Computati	onal Mathematics (201	2)				

Module title				Abbreviation		
Mathematical Logic					10-I=ML-102-m01	
Module	coord	inator		Module offered by		
Dean of	fStudi	es Informatik (Computer S	Science)	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate	Admission prerequis	site to assessment: e	exercises (type and scope to be	
			announced by the le	cturer at the beginni	ing of the course).	
Conten	ts					
Proposi rem, Gö	itional idel's i	logic, first-order predicat ncompleteness theorem,	e logic, proof and dee undecidability and n	duction, Gödel's com onaxiomatisability c	npleteness theorem, Tarski theo- of elemental arithmetic.	
Intende	ed lear	ning outcomes				
The stu predica theoren	dents   te logi n, unde	possess a fundamental a c, proof and deduction, G ecidability and nonaxiom	nd applicable knowle ödel's completeness atisability of element	edge in the areas of p theorem, Tarski the cal arithmetic.	propositional logic, first-order orem, Gödel's incompleteness	
Courses	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
V + Ü (n	io infoi	rmation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Method ster, inf	<b>l of ass</b> formati	<b>sessment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written tion dat aminati Langua	examin te, the ion in g ge of a	nation (approx. 50 to 60 r written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)	
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	е				
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	appea	ars in				
Master'	s degr	ee (1 major) Mathematics	(2012)			
Master'	s degr	ee (1 major) Computation	al Mathematics (201	2)		
First sta	ate exa	mination for the teaching	degree Gymnasium	Computer Science (2	2009)	

Module title				Abbreviation	
Program Design and Analysis					10-l=PA-102-m01
Module coordinator Module offered by			Module offered by		
holder	of the (	Chair of Computer Scienc	e ll	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	on .	Module level	Other prerequisites		
1 seme	ster	graduate	Where applicable, p	rereguisites as spec	ified by the lecturer at the begin-
		0	ning of the course (e	. g. completion of ex	xercises).
Conten	ts				
Program	n analy	sis, model creation in so	ftware engineering, p	rogram quality, test	of programs, process models.
Intend	ed lear	ning outcomes			
The stu quality	idents :	are able to analyse progra	ams, to use testing fra	ameworks and metri	cs as well as to judge program
Course	s (type	. number of weekly conta	ct hours, language —	if other than Germa	n)
V + Ü (r	<u>no info</u>	mation on SWS (weekly o	contact hours) and co	urse language avail	able)
Metho	d of ace	essment (type scope la	nguage — if other tha	n German, evamina	tion offered — if not even seme-
ster, in	formati	ion on whether module ca	an be chosen to earn	a bonus)	tion onered — it not every senie-
tion da aminat Langua	examin te, the ion in g ige of a	nation (approx. 50 to 60 i written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon wi	d by the lecturer by Il examination of on Is of 2: 20 minutes, Ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)
Allocat	ion of I	places			
Additio	onal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
Referre	ed to in	LPO I (examination regu	lations for teaching-d	egree programmes)	
Module	e appea	ars in			
Master	's degr	ee (1 major) Computer Sc	ience (2010)		
Master	Master's degree (1 major) Mathematics (2012)				
Master's degree (1 major) Mathematics (2010)					
Master's degree (1 major) Physics (2010)					
Master's degree (1 major) Physics (2011)					
Master's degree (1 major) Nanostructure Technology (2011)					
Master	's degr	ee (1 major) Nanostructui	re Technology (2010)		
Master	's degr	ee (1 major) Business Info	ormation Systems (20	911)	
Master	's degr	ee (1 major) Business Info	ormation Systems (20	13)	
Master	's degr	ee (1 major) Computation	al Mathematics (2012	2)	
First sta	ate exa	mination for the teaching	g degree Gymnasium (	Computer Science (2	2009)

Module title				Abbreviation		
Computer Arithmetic				10-I=RAM-102-m01		
Module	coord	inator		Module offered by		
holder	of the C	hair of Computer Science	e II	Institute of Compute	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
			ning of the course (e	e.g. completion of ex	(ercises).	
Conten	ts					
Spaces tic and	of num interva	nerical computation, rast l calculation.	er and rounding, defi	nition and implemer	ntation of computational arithme-	
Intende	ed learr	ning outcomes				
The stu and imp rithms.	dents p olemen	oossess knowledge abou tation of computational a	t the spaces of nume arithmetic and interva	rical computation, ra al calculation. They r	aster and roundings, definition naster the application of algo-	
Course	<b>s</b> (type,	number of weekly conta	ct hours, language —	if other than Germa	n)	
V + Ü (r	io infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Method ster, inf written	<b>l of ass</b> formati examir	essment (type, scope, la on on whether module ca nation (approx, 50 to 60 r	nguage — if other tha an be chosen to earn ninutes): if announce	an German, examina a bonus) ed by the lecturer by	tion offered — if not every seme-	
tion dat aminati Langua	te, the ion in g ge of a	written examination can roups (one candidate ea ssessment: German, Eng	be replaced by an ora ch: 15 minutes, group lish if agreed upon w	al examination of one os of 2: 20 minutes, s ith the examiner	e candidate each or an oral ex- groups of 3: 25 minutes)	
Allocat	ion of p	laces				
Additio	nal info	ormation				
Worklo	ad					
Teachir	ng cycle	e				
Referre	d to in	LPOI (examination regu	lations for teaching-c	legree programmes)		
Module	Module appears in					
Master's degree (1 major) Computer Science (2010) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2012)						
Master	s degre	e (1 major) Mathematics	al Mathematics (2011)	2)		
First sta	ate exa	mination for the teaching	degree Gymnasium	-) Computer Science (2	2009)	

Module title				Abbreviation			
Roboti	Robotics 10-I=RO-102-mo1						
Modul	e coord	inator		Module offered by			
holder of the Chair of Computer Science VII Institute of Computer Science			er Science				
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
8	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer	at the begin-	
			ning of the course (	e.g. completion of ex	kercises).		
Conter	Its		•				
History homog tor con Works se dyn lonomo Mover Sensor Intend The stu	History, applications and properties of robots, direct kinematics of manipulators: coordinate systems, rotations, homogenous coordinates, axis coordinates, arm equation. Inverse kinematics: solution properties, end effector configuration, numerical and analytical approaches, examples of different robots for analytical approaches. Workspace analysis and trajectory planning, dynamics of manipulators: Lagrange-Euler model, direct and inverse dynamics. Mobile robots: direct and inverse kinematics, propulsion system, tricycle, Ackermann steering, holonomes and non-holonome restrictions, kinematic classification of mobile robots, posture kinematic model. Movement control and path planning: roadmap methods, cell decomposition methods, potential field methods. Sensors: position sensors, speed sensors, distance sensors.						
Course	nemati s (type)	cs and dynamics as we . number of weekly cor	ell as the planning of pa Itact hours, language –	if other than Germa	n)		
V + Ü (	no infor	mation on SWS (week	v contact hours) and co	ourse language avail	able)		
Metho	d of ass	assment (type, scope	Janguage — if other th	an German, examina	tion offered — if not	every seme-	
ster, in	formati	on on whether module	can be chosen to earn	a bonus)		every serie	
written tion da aminat tion of examir Langua	examinate, the ite, the ion in gone can ination in age of a	nation (approx. 80 to 9 written examination ca groups. A 80 to 90 mini ndidate each, a 30 min n groups of 3. ssessment: German, E	o minutes). If announc in be replaced by an or ute written examinatior ute (approx.) oral exam nglish if agreed upon w	ed by the lecturer by al examination of on i is equivalent to a 20 nination in groups of vith the examiner	four weeks prior to f e candidate each or o minute (approx.) o 2 and a 40 minute (a	the examina- an oral ex- ral examina- approx.) oral	
Allocat	ion of p	olaces					
Additio	onal inf	ormation					
Workle	ad						
Toochi		•					
Teacin	ing cycu	e					
Reterred to in LPO I (examination regulations for teaching-degree programmes)							
 Module appears in							
Rechelor' degree (1 major) Aerospace Computer Science (2000)							
Bachel	or' deg	ree (1 major) Aerospac	e Computer Science (20	) )))			
Master	's degr	ee (1 major) Computer	Science (2010)	,			
Master	Master's degree (1 major) Authematics (2012)						
Master	's degr	ee (1 major) Mathemat	ics (2010)				
Master	's degr	ee (1 major) Computati	onal Mathematics (201	2)			
Master's w (2012)	ith 1 majoi	Computational Mathematics	JMU Würzburg • ge	enerated 26-Aug-2024 • exam ECTS) Computational Mather	n. reg. data re-	page 47 / 172	
(2012)							



First state examination for the teaching degree Gymnasium Computer Science (2009)

Master's with 1 major Computational Mathematics (2012)

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Computational Mathematics - 2012

Module title				Abbreviation			
Roboti	Robotics II: Networked Robots 10-I=RO2-102-mo1						
Module coordinator M			Module offered by				
holder	of the (	Chair of Computer Scienc	e VII	Institute of Comput	er Science		
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)			
8	nume	rical grade					
Durati	on	Module level	Other prerequisites				
1 seme	ester	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-		
			ning of the course (e	e.g. completion of ex	(ercises).		
Conter	nts						
Found	ations c	of dynamic systems, cont	rollability and observ	ability, controller de	sign through pole assignment:		
teedba	tound	reed-forward, state obse	rver, reedback with s	tate observer, time o hastic dynamic syste	IISCIPTE SYSTEMS, STOCHASTIC SY-		
itialisi	ng, app	lication examples, proble	ems of Kalman filters.	extended Kalman fi	lter.		
Intend	ed lear	ning outcomes	,				
The stu	udents i	 master all fundamentals	that are necessarv to	understand Kalman	filters and their use in applica-		
tions c	of roboti	cs. The students possess	s a knowledge of adv	anced controller and	observer methods and recogni-		
se the	connec	tions between the dual p	airs controllability - c	bservability as well	as controller design and observe		
design	. They a	also recognise the relation	nship between the Ka	alman filter as a state	e estimator and an observer.		
Course	es (type	, number of weekly conta	ct nours, language –	- if other than Germa	n)		
V + U (	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)		
<b>Metho</b> ster, ir	<b>d of ass</b> Iformati	sessment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
writter tion da amina tion of examin Langua	texamin ate, the tion in g one can nation in age of a	nation (approx. 80 to 90 written examination can groups. A 80 to 90 minute ndidate each, a 30 minut n groups of 3. ssessment: German. Eng	minutes). If announce be replaced by an ora e written examination e (approx.) oral exam lish if agreed upon w	ed by the lecturer by al examination of on i is equivalent to a 20 ination in groups of ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- o minute (approx.) oral examina- 2 and a 40 minute (approx.) oral		
Alloca	tion of p	olaces	0 1				
Additi	onal inf	ormation					
Worklo	bad						
Teachi	ng cycl	e					
Referr	<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module appears in							
Maste	r's degr	ee (1 major) Computer Sc	ience (2010)				
Maste	r's degr	ee (1 major) Mathematics	5 (2012)				
Maste	r's degr	ee (1 major) Mathematics	6 (2010)				
Master	r's degr	ee (1 major) Computation	al Mathematics (201	2)	)		
First st	First state examination for the teaching degree Gymnasium Computer Science (2009)						

Master's with 1 major Computational Mathematics	JMU Würzburg • generated 26-Aug-2024 • exam. reg. data re-	page 49 / 172
(2012)	cord Master (120 ECTS) Computational Mathematics - 2012	

Module title				Abbreviation		
Space	Spacecraft Systems Design 10-I=SSD-102-m01					
Modu	e coord	inator		Module offered by		
holder	of the (	Chair of Computer Scienc	e VII	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Durati	on	Module level	Other prerequisites			
1 seme	ester	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
			ning of the course (e	e.g. completion of ex	kercises).	
Conte	nts					
Introd orbits, angle on of t lemetr genera of spa Intend The st jor sul Course V + Ü ( Metho ster, ir writter tion da amina tion of exami	Contents   Introduction: history of space flight, system design of spacecraft. Space dynamics: two-body dynamics, Kepler orbits, disturbance forces, transfer orbits. Mission analysis: earth and sun-synchronous orbits, shadows, solar angle of incidence. Thermal control of satellites: thermal analysis, thermal design and technologies, verificati-on of thermal designs. Telecommunication: ground contact analysis, data transmission, satellite monitoring (telemetry, telecommando). Structure and mechanisms. Energy systems: primary, secondary, management, power generation: solar cells. On-board data processing. Propulsion systems. Tests (mechanical, electrical). Operation of spacecraft. Ground segment.   Intended learning outcomes   The students master system aspects of the layouting of technical systems. Using the example of spacecraft, major subsystems and their integration into a working whole are being analysed.   Courses (type, number of weekly contact hours, language — if other than German)   V + Ü (no information on SWS (weekly contact hours) and course language available)   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. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination and examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination in groups. Oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination in groups. Oral examination in groups. Oral examination in groups. Oral examination is equivalent to a 20 minute (approx.) oral examination in groups. Ora					
Langu	age of a	ssessment: German, Eng	lish if agreed upon w	ith the examiner		
Alloca	tion of p	olaces				
Additi	onal inf	ormation				
Workl	oad					
Teach	ng cycl	e				
Referr	<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Modu	e appea	ars in	• ( )			
Maste	r's degri	ee (1 major) Computer Sc	ience (2010)			
Maste	r's degr	ee (1 major) Mathematics	(2012) (2010)			
Maste	r's degr	ee (1 major) Computation	al Mathematics (201	2)		
				,		

Module title Abbreviation				Abbreviation		
Simula	Simulation Techniques for Performance Evaluation 10-I=ST-102-m01					
Modul	e coord	inator		Module offered by		
holder	of the (	Chair of Computer Scienc	e III	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	graduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
			ning of the course (e	e.g. completion of ex	kercises).	
Conter	nts					
Introdu	uction to	o simulation techniques,	statistical groundwo	rk, creation of rando	m numbers and random varia-	
measu	andom red dat	a planning and evaluation	ation techniques, sta	riments special ran	dom processes possibilities and	
limits	of mode	el creation and simulation	i, advanced concepts	and techniques, pr	actical execution of simulation	
project	ts.					
Intend	ed lear	ning outcomes				
The stu	dents	possess the methodic kn	owledge and the prac	ctical skills necessar	y for the stochastic simulation of	
(techn	ical) sys	stems, the evaluation of r	results and the correc	t assessment of the	possibilities and limits of simu-	
	s (type	s.	ct hours language -	if other than Germa	n)	
V LÜ(	no info	mation on SWS (wookly	contact hours) and co			
V + U (			nguaga if ather the		tion offered if not even come	
ster, in	<b>d of ass</b> Iformati	on on whether module ca	an be chosen to earn	a bonus)	tion offered — If not every seme-	
written tion da aminat tion of examin Langua	examinate, the tion in g one ca nation i age of a	nation (approx. 80 to 90 written examination can groups. A 80 to 90 minute ndidate each, a 30 minut n groups of 3. ssessment: German. Eng	minutes). If announce be replaced by an ora e written examination e (approx.) oral exam lish if agreed upon w	ed by the lecturer by al examination of on is equivalent to a 20 ination in groups of ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- o minute (approx.) oral examina- 2 and a 40 minute (approx.) oral	
Alloca	tion of I	olaces				
Additio	onal inf	ormation				
Worklo	bad					
Teachi	ng cycl	e				
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Modul	Module appears in					
Master	Master's degree (1 major) Computer Science (2010)					
Master	Naster's degree (1 major) Mathematics (2012)					
Master	's degr	ee (1 major) Mathematics	6 (2010)			
Master	's degr	ee (1 major) Computation	al Mathematics (201	2) Commutan Coisse (		
First st	First state examination for the teaching degree Gymnasium Computer Science (2009)					

Master's with 1 major Computational Mathematics	JMU Würzburg • generated 26-Aug-2024 • exam. reg. data re-	page 51 / 172
(2012)	cord Master (120 ECTS) Computational Mathematics - 2012	1

Module	e title				Abbreviation	
Algorithmic Graph Theory					10-I-AGT-122-m01	
Module	e coord	inator		Module offered by		
holder	of the (	Chair of Computer Scienc	e l	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate	Where applicable, p	rerequisites as spec	ified by the lecturer at the begin-	
-			ning of the course (e	e.g. completion of ex	kercises).	
Conten	ts					
We disc colouri of grap progran	cuss ty ngs, wo h prob ms or h	pical graph problems: We ork with planar graphs an lems, we also become far ow we show that they are	e solve round trip pro d find out how the ra miliar with new conce e fixed parameter con	blems, calculate ma nking algorithm of G pts, for example how nputable.	ximal flows, find matchings and oogle works. Using the examples w we model problems as linear	
Intende	ed lear	ning outcomes				
The stu cipants course,	idents a are ab , stude	are able to model typical le to decide which tool fr nts learn in detail how to	problems in compute om the course helps estimate the run time	er science as graph p solve a given graph e of given graph algo	problems. In addition, the parti- problem algorithmically. In this prithms.	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
V + Ü (r	no infoi	rmation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Metho ster, in	<b>d of ass</b> formati	sessment (type, scope, la ion on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written tion da aminat Langua	examin te, the ion in g ige of a	nation (approx. 50 to 60 i written examination can groups (one candidate ea ssessment: English, Gerr	minutes); if announce be replaced by an ora ch: 15 minutes, group nan if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)	
Allocat	ion of <sub>l</sub>	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Teachi		0				
Teacini	ig cyci	e				
Referre	a to in	<b>LPUT</b> (examination regu	lations for teaching-c	legree programmes)		
Module	Module appears in					
Bachel	Bachelor' degree (1 major) Mathematics (2012)					
Bachel	or' deg	ree (1 major) Mathematic	5 (2013) nal Mathematics (201	12)		
Bachel	or' deg	ree (1 major) Computatio	nal Mathematics (20.	· <i>z)</i> 13)		
Master	's degr	ee (1 major) Mathematics	5 (2012)	<i>ر</i> ر -		
Master	's degr	ee (1 major) Computation	al Mathematics (201	2)		
		•				

Modul	e title				Abbreviation		
Autom	Automation and Control Technology 10-I-AR-102-m01						
Module coordinator				Module offered by			
holder	of the (	Chair of Computer Scier	nce VII	Institute of Comput	er Science		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
8	nume	rical grade					
Durati	on	Module level	Other prerequisites	i			
1 seme	ester	undergraduate	Admission prerequi	site to assessment:	exercises (type and s	scope to be	
			announced by the le	ecturer at the beginn	ing of the course).		
Conte	nts						
Overvi functio structu nes, co cess s	Overview of automation systems, fundamental principles of control technology, Laplace transformation, transfer function, plant, controller types, basic feedback loop, fundamental principles of control engineering, automata, structure of Petri nets, Petri nets for automisation, machine-related structure of processing computation machines, communication between process computers and periphery devices, software for automation systems, pro-						
Intend	led lear	ning outcomes					
The st	udents i	master the fundamenta	ls of automation and c	ontrol.			
Course	<b>es</b> (type	, number of weekly con	tact hours, language –	- if other than Germa	ın)		
V + Ü (	no infoi	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
Metho ster, ir	<b>d of ass</b> nformati	essment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
tion of examin Langua Alloca	one can nation in age of a <b>tion of p</b>	ndidate each, a 30 min n groups of 3. ssessment: German, El <b>blaces</b>	ute (approx.) oral exam nglish if agreed upon w	nination in groups of	2 and a 40 minute (	approx.) oral	
Additi	onal inf	ormation					
Workle	oad						
Teachi	ing cycl	٩					
		•					
Referr	ed to in	<b>IPOI</b> (examination reg		degree programmes)			
Modul	e appea	irs in					
Bache	lor' deg	ree (1 major) Computer	Science (2010)				
Bache	Bachelor' degree (1 major) Mathematics (2012)						
Bachelor' degree (1 major) Mathematics (2013)							
Bache	Bachelor' degree (1 major) Computational Mathematics (2012)						
Bache	Bachelor' degree (1 major) Aerospace Computer Science (2009)						
Bache	Bachelor' degree (1 major) Aerospace Computer Science (2011)						
Maste	r's degr	ee (1 major) Computer S	Science (2010)				
Maste	r's degr	ee (1 major) Mathemati	cs (2012)				
Master's v (2012)	vith 1 majo	Computational Mathematics	JMU Würzburg • ge cord Master (120	enerated 26-Aug-2024 • exan ECTS) Computational Mather	n. reg. data re- natics - 2012	page 53 / 172	

### Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Computational Mathematics (2012) First state examination for the teaching degree Gymnasium Computer Science (2009)

Module title Abbreviation						
Databa	Databases 10-I-DB-102-m01					
Module coordinator Module offered b			Module offered by	·		
Dean c	of Studie	es Informatik (Computer	Science)	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade		1		
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate	Admission prerequi	site to assessment:	exercises (type and s	scope to be
1 50000	5001		announced by the le	ecturer at the beginn	ing of the course)	
Conton				securer at the beginn		
Conter	Its					
Relatio ment.	nal algo	ebra and complex SQL st	atements; database	planning and norma	l forms; transaction	manage-
Intend	ed learı	ning outcomes				
The stu	idents i	possess knowledge abou	It database modelling	g and queries in SQL	as well as transaction	ons.
Course	s (type	number of weekly conta	oct hours language -	- if other than Germa	n)	
V · Ü (	no infor	mation on SWS (wookly	contact hours) and co		abla)	
V + U (						
<b>Metho</b> ster, in	<b>d of ass</b> formati	on on whether module c	anguage — if other th an be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
if anno ced by nutes, Langua	examin ounced an oral groups age of a	nation (approx. 50 to 60 by the lecturer by four we examination of one can of 2: 20 minutes, groups ssessment: German, Eng	minutes) eeks prior to the exan didate each or an ora 5 of 3: 25 minutes) glish if agreed upon w	nination date, the wr l examination in grou vith the examiner	itten examination ca ups (one candidate e	n be repla- each: 15 mi-
Allocat	ion of r	places	<u> </u>			
Additid	nalinf	ormation				
Auunn						
Worklo	ad					
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regu	llations for teaching-	degree programmes)		
§ 49 (1 § 60 (1	) 1. b) D	atenbanksysteme und S Jatenbanksysteme und S	oftwaretechnologie	<u> </u>		
Modul	) 1. 0 <i>)</i> 0	arc in	onwareteennotogie			
Deebel	e appea	us III ree (, meier) Cemeruter C				
Bachel	or deg	ree (1 major) Computer S ree (1 major) Mathematic	cience (2010)			
Dachel	or deg	ree (1 major) Mathematic	.5 (2012)			
Dachel	or deg	ree (1 major) Mathematic	.5 (2013) formation Systems (a	2012)		
Dachelor' dograe (1 major) Computational Mathematics (2013)						
Bachel	or' deg	ree (1 major) Computatio	nal Mathematics (20	12)		
Bachel	Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Aerospace Computer Science (2000)					
Bachelor' degree (1 major) Aerospace Computer Science (2009)						
Bachelor' degree (1 major) Functional Materials (2012)						
Master	Master's degree (1 major) Computer Science (2010)					
Master	Master's degree (1 major) Computer Science (2010) Master's degree (1 major) Mathematics (2012)					
Master	's degr	ee (1 major) Mathematics	5 (2010)			
Master's w	ith 1 major	r Computational Mathematics	JMU Würzburg • ge	enerated 26-Aug-2024 • exan	1. reg. data re-	page 55 / 172

### Julius-Maximilians-UNIVERSITÄT WÜRZBURG



Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Computational Mathematics (2012) First state examination for the teaching degree Realschule Computer Science (2012) First state examination for the teaching degree Gymnasium Computer Science (2009)

Module title				Abbreviation	
Data Mining	Data Mining 10-I-DM-102-m01				
Module coord	inator		Module offered by		
holder of the	Chair of Computer Scienc	e VI	Institute of Comput	er Science	
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)		
5 nume	rical grade		1		
Duration	Module level	Other prerequisites			
1 semester	undergraduate	Admission prerequi	site to assessment: (	exercises (type and scope to be	
		announced by the le	ecturer at the beginn	ing of the course).	
Contents					
Foundations i model, relatio methods (clus SVM), learnin	n the following areas: de nship to data warehouse ster and association meth g methods for special dat	finition of data minin and OLAP, data prep nods), supervised lea ta types, other learnin	g and knowledge, di processing, data visu rning (e.g. Bayes cla ng paradigms.	scovery in databases, process Ialisation, unsupervised learning assification, KNN, decision trees,	
Intended lear	ning outcomes				
The students ta mining and the knowledg or implementa	possess a theoretical and machine learning. They a e acquired in this course ation of data mining algo	d practical knowledge are able to solve prac and by using the KDI rithms.	e of typical methods tical knowledge disc O process. They have	and algorithms in the area of da- covery problems with the help of acquired experience in the use	
Courses (type	, number of weekly conta		- if other than Germa	ın)	
V + Ü (no info	rmation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Method of ass ster, informat	sessment (type, scope, la ion on whether module ca	inguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written exami tion date, the amination in g Language of a	nation (approx. 50 to 60 l written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ch: 15 minutes, grou lish if agreed upon w	ed by the lecturer by al examination of on ps of 2: 20 minutes, vith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)	
Allocation of	places	<u> </u>			
Additional inf	ormation				
Workload					
Teaching cycl	e				
Referred to in	LPOI (examination regu	lations for teaching-o	degree programmes)		
	• • • • • •				
Module appea	ars in				
Bachelor' deg	ree (1 major) Computer S	cience (2010)			
Bachelor' deg	ree (1 major) Business In	formation Systems (2	2013)		
Bachelor' deg	3achelor' degree (1 major) Aerospace Computer Science (2009)				
Bachelor' deg	3achelor' degree (1 major) Aerospace Computer Science (2011)				
Master's degr	Naster's degree (1 major) Computer Science (2010)				
Master's degr	ee (1 major) Mathematics	5 (2012)			
Master's degr	ee (1 major) Mathematics	5 (2010)			
Master's degr	ee (1 major) Computation	al Mathematics (201	2)	)	
FIRST STATE exa	mination for the teaching	g degree Gymnasium	Computer Science (2	2009)	

Master's with 1 major Computational Mathematics	JMU Würzburg • generated 26-Aug-2024 • exam. reg. data re-	page 57 / 172
(2012)	cord Master (120 ECTS) Computational Mathematics - 2012	

Module title				Abbreviation		
Theory of Complexity 10-I-KT-102-m01						
Modul	<u></u>	instar		Modulo offered by		
Mouut			<b>C</b> .:	Module offered by		
Dean d	of Studi	es Informatik (Computer	Science)	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Durati	on	Module level	Other prerequisites			
1 seme	ester	undergraduate	Admission prerequi	site to assessment:	exercises (type and s	scope to be
	_		announced by the le	ecturer at the beginn	ing of the course).	
Conter	nts					
Compl sumpt thods,	exity m ion vers P-NP p	easurements and classe sus computation time, de roblem, completeness p	s, general relationshi eterminism versus inc roblems, Turing reduc	ps between space ar leterminism, hierarcl tion, interactive proc	nd time classes, mer nical theorems, trans of systems.	nory con- slation me-
Intend	ed lear	ning outcomes				
The stu classe detern proble	udents s, gene ninism v ms, Tur	possess a fundamental a ral relationships between versus indeterminism, hi ing reduction, interactive	and applicable knowle n space and time clas erarchical theorems, e proof systems.	edge in the areas of ses, memory consur translation methods	complexity measure nption versus comp , P-NP problem, com	ments and utation time, pleteness
Course	<b>es</b> (type	, number of weekly conta	act hours, language –	- if other than Germa	n)	
V + Ü (	no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Metho	d of as	sessment (type scope )	anguage — if other th	an German, examina	tion offered — if not	every seme-
ster, ir	format	ion on whether module c	an be chosen to earn	a bonus)		every serife
tion da amina Langua	tion in gage of a	written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ach: 15 minutes, grou glish if agreed upon w	ed by the lecturer by al examination of on ps of 2: 20 minutes, vith the examiner	e candidate each or groups of 3: 25 minu	ine examina- an oral ex- ites)
Alloca	tion of p	places				
Additi	onal inf	ormation				
Workle	oad					
Teachi	ing cycl	Δ				
reaction	ing cyce					
 Deferre						
Referr		LPUT (examination regu		legree programmes)		
 Modul	0 2000	arc in				
Decho	e appea	als III				
Bache	lor deg	ree (1 major) Computer S	c(2010)			
Bache	Bachelor' degree (1 major) Mathematics (2012)					
Bache	Bachelor' degree (1 major) (computational Mathematics (2012)					
Bache	Bachelor' degree (1 major) Computational Mathematics (2012)					
Bache	Bachelor' degree (1 major) Aerospace Computer Science (2000)					
Bache	lor' deg	ree (1 major) Aerospace	Computer Science (20	D11)		
Maste	Master's degree (1 major) Computer Science (2010)					
Maste	r's degr	ee (1 major) Mathematic	s (2012)			
Maste	r's degr	ee (1 major) Mathematic	s (2010)			
Master's v	vith 1 majo	r Computational Mathematics	JMU Würzburg ● ge	enerated 26-Aug-2024 • exan	n. reg. data re- natics - 2012	page 58 / 172



Master's degree (1 major) Computational Mathematics (2012) First state examination for the teaching degree Gymnasium Computer Science (2009)

Module title				Abbreviation		
Computer Architecture 10-I-RAK-102-m01						
Modul	e coord	inator		Module offered by		
Dean d	of Studi	es Informatik (Compute	r Science)	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. con	nol. of module(s)		
5	nume	rical grade				
Durati	<u> </u>	Madula laval	Other prorequisites			
	ostor	undorgraduato	Admission proroqui	site to according	overcises (type and a	scopo to bo
1 Seine	SICI	undergraduate	Aumission prefequi	site to assessment.	ing of the course)	scope to be
	_				ing of the course).	
Conter	nts					
Instruc ling, ca	tion se	t architectures, commany vector processors, multi	nd processing through -core processors.	pipelining, statical a	and dynamic instruct	ion schedu:
Intend	ed lear	ning outcomes				
The stu compi	udents I lers and	master the most import	ant techniques to desi	gn fast computers as	s well as their interac	ction with
Course	es (type	number of weekly con	 tact hours, language	- if other than Germa	n)	
V ± Ü (	no info	mation on SWS (weekly	(contact hours) and co	urse language avail	able)	
					tion offered if not	
ster, ir	<b>d of ass</b> Iformati	on on whether module	can be chosen to earn	a bonus)	tion offered — if not	every seme-
writter	ı exami	nation (approx. 50 to 60	o minutes); if announc	ed by the lecturer by	four weeks prior to t	he examina-
tion da	te, the	written examination ca	n be replaced by an or	al examination of on	e candidate each or	an oral ex-
amina	tion in g	groups (one candidate e	each: 15 minutes, grou	ps of 2: 20 minutes,	groups of 3: 25 minu	ites)
Langua	age of a	ssessment: German, Er	iglish if agreed upon w	lith the examiner		
Alloca	tion of <sub>l</sub>	olaces				
Additi	onal inf	ormation				
Workle	had					
-						-
Teachi	ng cycl	е				
Referre	ed to in	LPOI (examination reg	gulations for teaching-o	degree programmes)		
§ 69 (1	.) 1. c) Ir	nformatik Technische In	formatik			
Modul	e appea	ars in				
Bache	lor' deg	ree (1 major) Computer	Science (2010)			
Bache	lor' deg	ree (1 major) Mathemat	ics (2012)			
Bache	lor' deg	ree (1 major) Mathemat	ics (2012)			
Bache	lor' deg	ree (1 major) Computati	onal Mathematics (20	12)		
Bache	lor' deg	ree (1 major) Computati	onal Mathematics (20	) 13)		
Bachelor' degree (1 major) Aerospace Computer Science (2000)						
Bachelor' degree (1 major) Aerospace Computer Science (201)						
Master's degree (1 major) Computer Science (2010)						
Maste	Master's degree (1 major) Mathematics (2012)					
Maste	Master's degree (1 major) Mathematics (2010)					
Maste	Master's degree (1 major) Physics (2010)					
Maste	r's degr	ee (1 major) Physics (20	011)			
Maste	r's degr	ee (1 major) Nanostruct	ure Technology (2011)			
Master's w (2012)	/ith 1 majo	r Computational Mathematics	JMU Würzburg • ge cord Master (120	enerated 26-Aug-2024 • exan ECTS) Computational Mather	n. reg. data re- natics - 2012	page 60 / 172



Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Computational Mathematics (2012)

Module title				Abbreviation			
Compu	Computer Networks and Communication Systems 10-I-RK-102-m01						
Modul	Modulo coordinator Module				<u> </u>		
Modul							
nolder	ofthe	chair of Computer Scier		Institute of Comput	erScience		
ecis o	Metho	rical grading	Only after succ. con	npl. of module(s)			
0 D 1	Inume						
Durati	on	Module level	Other prerequisites	cito to occorrement.	avaraicas (tura and	seens to be	
1 seme	ester	undergraduate	Admission prerequi	site to assessment:	exercises (type and s	scope to be	
				ecturer at the beginn	ing of the course).		
Contei	nts						
Proper	ties of o	computer and communi	cation systems: data t	raffic in distributed s	systems. Performanc	e analysis	
of com	iputer n	etworks and communic	ation systems: proble	m statement and intr	roduction to method	architecture	
and st	ructure	of computer networks:	network structure, net	work access, access	methods, digital tra	nster hierar-	
and IS	0 archi	tecture models Interne	t. structure and basic r	nechanism_TCP/IP	routing network mai	nagement	
Mobile	e comm	unication networks: fur	idamental concepts. G	SM. UMTS. Future co	ommunication system	ns and net-	
works.	•			,	,		
Intend	ed lear	ning outcomes					
The st	udents	possess an intricate kn	owledge of the structu	re of computer netwo	orks and communica	tion systems	
as wel	l as fun	damental principles to	rate these systems.				
Course	<b>es</b> (type	, number of weekly con	tact hours, language –	- if other than Germa	ın)		
V + Ü (	no info	rmation on SWS (weekly	y contact hours) and co	ourse language avail	able)		
Metho	d of ass	sessment (type, scope,	language — if other th	an German, examina	tion offered — if not	every seme-	
ster, ir	nformat	ion on whether module	can be chosen to earn	a bonus)			
writter	ı exami	nation (approx. 80 to 90	o minutes). If announc	ed by the lecturer by	four weeks prior to	the examina-	
tion da	ate, the	written examination ca	n be replaced by an or	al examination of on	e candidate each or	an oral ex-	
amina	tion in ទ្	groups. A 80 to 90 minu	ite written examinatior	is equivalent to a 2	o minute (approx.) o	ral examina-	
tion of	one ca	ndidate each, a 30 min	ute (approx.) oral exan	nination in groups of	2 and a 40 minute (	approx.) oral	
Langu	nation i age of a	n groups of 3. Issessment: German Fr	nglish if agreed upon w	vith the examiner			
Alloca	tion of						
Alloca		places					
Additi	onal Inf	ormation					
Workle	oad						
Teachi	ing cycl	e					
Referr	ed to in	LPOI (examination reg	gulations for teaching-	degree programmes)			
Modul	Module appears in						
Bachelor' degree (1 major) Computer Science (2010)							
Bache	Bachelor' degree (1 major) Mathematics (2012)						
Bache	Bachelor' degree (1 major) Mathematics (2013)						
Bache	Bachelor' degree (1 major) Computational Mathematics (2012)						
Bache	lor' deg	ree (1 major) Computat	ional Mathematics (20	13)			
Гвасре	ior' deg	ree (1 major) Aerospace	e Computer Science (20	009)			
Master's v	vith 1 majo	r Computational Mathematics	JMU Würzburg • g	enerated 26-Aug-2024 • exan	n. reg. data re-	page 62 / 172	
(2012)			cord Master (120	ECTS) Computational Mather	matics - 2012		

### Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Computer Science (2010) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Computational Mathematics (2012) First state examination for the teaching degree Gymnasium Computer Science (2009)

Module title					Abbreviation		
Knowledge-based Systems					10-I-WBS-102-m01		
Module coordinator				Module offered by			
holder	of the (	Chair of Computer Scienc	e VI	Institute of Comput	er Science		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
5	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	undergraduate					
Conten	Contents						
Founda thods,	ations i knowle	n the following areas: kno dge acquisition, learning	owledge managemen g, guidance dialogue,	t systems, knowledg semantic web.	ge representation, solving me-		
Intende	ed lear	ning outcomes					
The stu system	dents   s inclu	oossess theoretical and p ding knowledge formalise	practical knowledge for ation and have acquire	or the understanding red experience in a s	g and design of knowledge-based small project.		
Course	<b>s</b> (type	, number of weekly conta	ict hours, language —	if other than Germa	n)		
V + Ü (r	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)		
Methoo ster, in	<b>d of ass</b> formati	<b>essment</b> (type, scope, la on on whether module ca	inguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
if anno ced by nutes, g Langua	if announced by the lecturer by four weeks prior to the examination date, the written examination can be repla- ced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 mi- nutes, groups of 2: 20 minutes, groups of 3: 25 minutes) Language of assessment: German, English if agreed upon with the examiner						
Allocation of places							
Additio	nal inf	ormation					
 Worklo							
workload							
Teaching cycle							
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)							
Module appears in							
Bachelor' degree (1 major) Computer Science (2010)							
Bachelor' degree (1 major) Business Information Systems (2013)							
Bachelor' degree (1 major) Aerospace Computer Science (2009)							
Bachelor degree (1 major) Aerospace Computer Science (2011)							
Master's degree (1 major) Computer Science (2010)							
Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010)							
Master	Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Computational Mathematics (2012)						
First st	First state examination for the teaching degree Gymnasium Computer Science (2009)						
This state examination for the teaching degree dynnasian computer science (2009)							

Module title				Abbreviation			
Applied Analysis 10-M=AAAN-102-m01					01		
Module coordinator				Module offered by	le offered by		
Deep of Studies Mothematik (Mothema			matics)				
	Moth	es mathematik (mathe		nl of modulo(c)	latics		
	numo	rical grado		Unly after succ. compl. of module(s)			
	Inume						
Duratio	on	Module level	Other prerequisites	avaraica must ha ma	da via CR@hama at	the herin	
1 semester		graduate	Registration for the	Registration for the exercise must be made via SB@nome at the begin-			
			the specified regist	ance with			
			the specified registration deadlines. Certain prerequisites must				
			to qualify for admission to assessment (e. g. successful completion certain percentage of exercises). The lecturer will inform students a				
				is at the beginning o	o the course. Registr		
			exercise will be con	sidered a declaration	n of will to seek adm	ission to as-	
			sessment. If studen	ts nave obtained the	e qualification for ad	mission to	
			assessment over the	e course of the seme	ester, the lecturer will	it put their re-	
			gistration for assess	sment into effect. Su	idents who meet all	prerequisites	
			will be admitted to a	assessment in the cu	arrent or in the subse	equent seme-	
			Ster. For assessmen	i al a later date, stud	ients will have to ob	itam the qua-	
	-		lification for admiss	ion to assessment a	new.		
Conten	its						
In-dept	th study	y of functional analysis	and operator theory, S	obolev spaces and p	partial differential ec	juations,	
theory	of Hilb	ert spaces and Fourier	analysis, spectral theor	y and quantum mec	hanics, numerical m	ethods (in	
theory	of ellin	tic parabolic and hype	of functional analysis, i arbolic partial differenti	al equations with me	bedding theorems, c	ompactness,	
	oremp					lat anatysis.	
Recom	mende	d previous knowledge	:				
Familia	arity wit	h the contents of the r	nodule "Functional Ana	lysis" is strongly reco	ommended.		
Intend	ed lear	ning outcomes					
The stu	udent is	acquainted with the f	undamental notions, m	ethods and results o	of higher analysis. He	e/She is able	
to esta	blish a	connection between h	is/her acquired skills a	nd other branches o	f mathematics and c	questions in	
physics	physics and other natural and engineering sciences.						
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)							
V + Ü (no information on SWS (weekly contact hours) and course language available)							
<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)							
At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written							
examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral exami-							
nation in groups (groups of 2, approx. 30 minutes)							
Assessment offered and in the subsequent offered and in the subsequent							
Language of assessment: German. English							
Allocation of places							
Worklo	ad						
Master's w	ith 1 majo	r Computational Mathematics	JMU Würzburg • ge	enerated 26-Aug-2024 • exan	n. reg. data re-	page 65 / 172	
(2012)			cord Master (120	ECTS) Computational Mather	matics - 2012		

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

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# Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Module title					Abbreviation				
Topics in Algebra					10-M=AALG-102-m01				
Module coordinator				Module offered by					
Dean of Studies Mathematik (Mathematics)			hematics)	Institute of Mathematics					
ECTS	S Method of grading Only after succ. o			mpl. of module(s)					
10	nume	erical grade							
Duratio	on	Module level	Other prerequisites	Other prerequisites					
1 seme	ester	graduate	Registration for the	Registration for the exercise must be made via SB@home at the begin-					
			ning of the course o	ning of the course or as announced by the lecturer in accordance with					
			the specified regist	the specified registration deadlines. Certain prerequisites must be met					
			to qualify for admis	to qualify for admission to assessment (e.g. successful completion of a					
			certain percentage	certain percentage of exercises). The lecturer will inform students about					
			the respective deta	the respective details at the beginning of the course. Registration for the					
			exercise will be con	exercise will be considered a declaration of will to seek admission to as-					
			sessment. If students have obtained the qualification for admission to						
as gi w st			assessment over th	assessment over the course of the semester, the lecturer will put their re-					
			gistration for asses	gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-					
			will be admitted to						
			ster. For assessmer						
		lification for admiss	lification for admission to assessment anew.						
Contents									
Contemporary topics in algebra, for example coding theory, elliptic curves, algebraic combinatorics or computer algebra.									
Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and									

"Applied Algebra".

Intended learning outcomes

The student is acquainted with fundamental concepts and methods in a contemporary field of algebra, and is able to apply these skills to complex questions.

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

V + Ü (no information on SWS (weekly contact hours) and course language available)

**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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

**Allocation of places** 

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### Additional information

Workload

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

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Mathematical Physics (2012)

Module title				Abbreviation	
Differential	Geometry			10-M=ADGM-102-m01	
Module coor	dinator		Module offered by		
Dean of Stud	lies Mathematik (Mathe	matics)	Institute of Mathematics		
ECTS Method of grading		Only after succ. con	Only after succ. compl. of module(s)		
10 num	erical grade				
Duration	Module level	Other prerequisites	i		
1 semester	graduate	Registration for the ning of the course of the specified registration to qualify for admiss certain percentage of the respective detail exercise will be con sessment. If studen assessment over th gistration for assess will be admitted to a ster. For assessment	exercise must be may ration deadlines. Cer sion to assessment of of exercises). The lead ils at the beginning of sidered a declaration ts have obtained the e course of the seme sment into effect. Str assessment in the cu at a later date, stud	ade via SB@home at the begin- he lecturer in accordance with rtain prerequisites must be met (e. g. successful completion of a cturer will inform students about of the course. Registration for the n of will to seek admission to as- e qualification for admission to ester, the lecturer will put their re- udents who meet all prerequisites urrent or in the subsequent seme- dents will have to obtain the qua- new.	

### Contents

Central and advanced results in differential geometry, in particular about differentiable and Riemannian manifolds.

Recommended previous knowledge:

Basic knowledge from the modules "Introduction to Differential Geometry", "Introduction to Topology" and "Geometric Analysis" is recommended.

### Intended learning outcomes

The student is acquainted with concepts and methods for differentiable manifolds or Riemannian manifolds, is able to apply these methods and knows about the interaction of local and global methods in differential geometry.

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

V + Ü (no information on SWS (weekly contact hours) and course language available)

**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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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

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# Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Module title					Abbreviation				
Complex Analysis					10-M=AFTH-102-m01				
Module coordinator				Module offered by					
Dean of Studies Mathematik (Mathematics)			ematics)	Institute of Mathematics					
ECTS	ECTS Method of grading Only after suc			npl. of module(s)					
10 numerical grade									
Duratio	on	Module level	Other prerequisites	Other prerequisites					
1 seme	ster	graduate	Registration for the exercise must be made via SB@home at the begin-						
			ning of the course or as announced by the lecturer in accordance with						
			the specified registr	the specified registration deadlines. Certain prerequisites must be met					
			to qualify for admiss	to qualify for admission to assessment (e.g. successful completion of a					
			certain percentage of	certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as-					
			the respective detai						
			exercise will be con						
			sessment. If studen	sessment. If students have obtained the qualification for admission to					
assessr		assessment over th	assessment over the course of the semester, the lecturer will put their re-						
			gistration for assess	gistration for assessment into effect. Students who meet all prerequisites					
			will be admitted to a	will be admitted to assessment in the current or in the subsequent seme ster. For assessment at a later date, students will have to obtain the qua-					
			ster. For assessmen						
			lification for admiss	ion to assessment a	new.				
Contents									
In-depth study of mapping properties of analytic functions and their generalisations with modern analytic and geometric methods. Structural properties of families of holomorphic and meromorphic functions. Special functions (e. g. elliptic functions).									
Recommended previous knowledge: Basic knowledge of the contents of the module "Introduction to Complex Analysis" is recommended.									
Intended learning outcomes									

The student is acquainted with the fundamental notions, methods and results of higher complex analysis, in particular the (geometric) mapping properties of holomorphic functions. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and applications in other subjects.

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

V +  $\ddot{U}$  (no information on SWS (weekly contact hours) and course language available)

**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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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

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# Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)
Module	e title				Abbreviation	
Geome	tric Str	ructures			10-M=AGMS-102-m01	
Module	e coord	inator		Module offered by	·	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
Duration Module level   1 semester graduate		Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-				
Conten	ts					
Tits buildings, generalised polygons or related geometric structures, automorphisms, BN pairs in groups, Mouf- ang conditions, classification results. Recommended previous knowledge: Basic knowledge from the modules "Introduction to Differential Geometry" and "Introduction to Topology" is re- commended						
Intended learning outcomes						
The student is acquainted with the fundamental notions, methods and results concerning a type of geometric structure. He/She is able to establish a connection between these results and broader theories, and learns about the interactions of geometry and other fields of mathematics.						
Course	<b>Courses</b> (type, number of weekly contact hours, language — if other than German)					

V + Ü (no information on SWS (weekly contact hours) and course language available)

**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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Language of assessment: German, English

# Allocation of places

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# Additional information

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Workload

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Teaching cycle

Master's with 1	major Computational Mathematics
(2012)	

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

## Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module title					Abbreviation	
Giovan	Giovanni-Prodi Lecture (Master) 10-M=AGPC-102-m01					
Modul	e coord	inator		Module offered by		
Dean o	of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS Method of grading Only after succ. compl. of module(s)						
5	nume	rical grade		• • • •		
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Registration for the	exercise must be ma	de via SB@home at	the begin-
			ning of the course o	r as announced by th	ne lecturer in accorda	ance with
			the specified registr	ation deadlines. Cer	tain prerequisites mu	ust be met
			to qualify for admiss	sion to assessment (	e.g. successful com	pletion of a
			certain percentage o	of exercises). The lec	turer will inform stud	lents about
			the respective detai	is at the beginning o	f the course. Registra	ation for the
			exercise will be con	sidered a declaration	n of Will to seek admi	ssion to as-
			sessment. If studen	is have obtained the	stor the lecturer will	nut thoir ro-
			gistration for assess	ment into effect Stu	idents who meet all r	nrerequisites
			will be admitted to a	assessment in the cu	irrent or in the subse	auent seme-
			ster. For assessmen	t at a later date. stud	lents will have to obt	tain the qua-
			lification for admiss	ion to assessment a	new.	
Conter	its		,			
Introdu	uction t	o a specialised topic in n	nathematics by an int	ernational expert.		
Intend	ed lear	ning outcomes				
The stu	udent is	acquainted with the fun	damental concepts a	nd methods of a con	temporary research	topic in ma-
themat	tics. He	/She is able to establish	a connection betwee	n his/her acquired s	kills and other brand	:hes of ma-
thema	tics and	applications in other su	ibjects.		>	
Course	s (type	, number of weekly conta	act nours, language –	- if other than Germa	n)	
V + U (1	no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
ster, in	<b>d of as</b> format	ion on whether module c	anguage — if other the an be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
At the	beginni	ing of the course, the lect	turer will choose one	of the following met	hods of assessment:	a) written
nation	in grou	ns (grouns of 2, approx	20 minutes)	candidate each (app	(0, 15  minutes), c)	Srat exami-
Langua	age of a	ssessment: English, Ger	man if agreed upon w	ith the examiner		
Allocat	ion of <sub>l</sub>	places				
Additio	onal inf	ormation				
			_			
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master	's degr	ee (1 major) Mathematics	5 (2012)			
Master's w (2012)	ith 1 majo	r Computational Mathematics	JMU Würzburg • ge cord Master (120	enerated 26-Aug-2024 • exam ECTS) Computational Mather	n. reg. data re- natics - 2012	page 75 / 172

#### Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012) exchange program Mathematics (2023)

Module	title				Abbreviation
Lie Theory					10-M=ALTH-102-m01
Module	coordinator			Module offered by	·
Dean of	Studies Math	ematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Method of gra	ading	Only after succ. con	pl. of module(s)	
10	numerical gra	de			
Duration	n Module	e level	Other prerequisites		
1 semes	ter gradua	lte	Other prerequisitesRegistration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-		
Content	S				
Linear Lie groups and their Lie algebras, exponential function, structure and classification of Lie algebras, classic examples, applications, e. g. in physics and control theory. Recommended previous knowledge:					

Basic knowledge of the contents of the modules "Functional Analysis" and "Introduction to Topology" is recommended. Furthermore, basic knowledge of the contents of the module "Introduction to Differential Geometry" is useful.

Intended learning outcomes

The student is acquainted with the fundamental results, theorems and methods in Lie theory. He/She is able to apply these to common problems, and knows about the interactions of group theory, analysis, topology and line-ar algebra.

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

V + Ü (no information on SWS (weekly contact hours) and course language available)

**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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Master's with	1 major Computational Ma	athematics
2012)		

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

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# Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Module	title				Abbreviation	
Numeric of large Systems of Equations					10-M=ANGG-102-m01	
Module	coord	inator		Module offered by		
Dean of	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Registration for the	exercise must be ma	ade via SB@home at the begin-	
			ning of the course o	r as announced by tl	he lecturer in accordance with	
			the specified registr	ation deadlines. Cer	tain prerequisites must be met	
			to qualify for admiss	sion to assessment (	(e.g. successful completion of a	
			certain percentage o	of exercises). The lec	turer will inform students about	
			the respective detai	ls at the beginning o	of the course. Registration for the	
			exercise will be con	sidered a declaration	n of will to seek admission to as-	
			sessment. If studen	ts have obtained the	e qualification for admission to	
			distration for accoss	e course or the seme	idents who most all proroquisitos	
			will be admitted to a	sment into enect. Su	uterits who meet all prerequisites	
			ster For assessmen	t at a later date stur	dents will have to obtain the qua-	
			lification for admiss	ion to assessment a	new	
Conton	tc					
Discreti	isation	of elliptic differential equ	uations, classical iter	ration methods, prec	conditioners, multigrid methods.	
Recomr Basic k and "Nu is also	mende nowlec umerica recomr	d previous knowledge: lge of numerical mathem al Mathematics 2", is req nended.	atics, such as that ac uired. Knowledge of t	cquired in the modul the contents of the n	les "Numerical Mathematics 1" nodule "Basics in Optimization"	
Intende	ed learı	ning outcomes				
The stu the mos	dent is st effici	acquainted with the mos ient way to solve a given	st important methods system of equations.	s for solving large sy	stems of equations, and knows	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	an)	
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Method ster, inf	<b>l of ass</b> formati	<b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	ition offered — if not every seme-	
At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral exami- nation in groups (groups of 2, approx. 30 minutes) Language of assessment: German, English						
Allocation of places						
Additional information						
Worklo	ad					

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

## Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module title				Abbreviation			
Basics of Optimization 10-M=AOPT-102-m01					10-M=AOPT-102-m01		
Modul	e coord	linator		Module offered by			
Dean of Studies Mathematik (Mathematics)				Institute of Mathem	atics		
ECTS	Meth	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
10	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ester	graduate	Registration for the	exercise must be ma	de via SB@home at the begin-		
			ning of the course o	r as announced by th	ne lecturer in accordance with		
			the specified registr	ation deadlines. Cer	tain prerequisites must be met		
			to qualify for admiss	sion to assessment (	e.g. successful completion of a		
			certain percentage o	of exercises). The lec	turer will inform students about		
			the respective detai	ls at the beginning o	f the course. Registration for the		
			exercise will be cons	sidered a declaration	n of Will to seek admission to as-		
			sessment. If studen	a course of the come	stor the locturer will put their re-		
			gistration for assess	ment into effect Stu	idents who meet all prerequisites		
			will be admitted to a	assessment in the cu	urrent or in the subsequent seme-		
			ster. For assessmen	t at a later date. stud	lents will have to obtain the gua-		
			lification for admiss	ion to assessment a	new.		
Conter	nts						
Fundar	mental	methods and technique	s in continuous ontim	ization unrestricted	optimization conditions for opti-		
mality,	, restric	ted optimization, exam	ples and applications i	n natural and engine	eering sciences as well as econo-		
mics.			· · · ·	U	5		
Intend	ed lear	ning outcomes					
The stu ses an	udent k d can d	nows the fundamental lecide which method is	methods of continous of the most suitable in ap	optimization, can juc oplications.	lge their strengths and weaknes-		
Course	<b>es</b> (type	, number of weekly con	tact hours, language –	- if other than Germa	n)		
V + Ü (	no info	rmation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
<b>Metho</b> ster, in	<b>d of as</b> format	<b>sessment</b> (type, scope, ion on whether module	language — if other tha can be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
At the	beginn	ing of the course, the le	cturer will choose one	of the following met	nods of assessment: a) written		
examir	nation (	(90 to 120 minutes), b) (	oral examination of one	e candidate each (ap	pprox. 20 minutes), c) oral exami-		
Assess	sment c	offered: Assessment offered	ered in the semester in	which the course is	offered and in the subsequent		
semes	ter, cou	irse offered on demand	or every four semester	S.	onelea ana mane sabsequent		
Langua	age of a	assessment: German, Er	nglish				
Allocat	tion of	places					
Additio	onal inf	ormation					
Workload							
Teaching cycle							
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)							
Master's w	aster's with 1 major Computational Mathematics JMU Würzburg • generated 26-Aug-2024 • exam. reg. data re- page 81 / 172						
(2012)			cord Master (120	ECTS) Computational Mather	natics - 2012		

# Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module	title				Abbreviation
Introduction to Control Theory					10-M=ARTH-102-m01
Module	coord	inator		Module offered by	·
Dean of	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics
ECTS	Methe	od of grading	Only after succ. con	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate	Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be cons sessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessmen lification for admiss	exercise must be ma r as announced by the ration deadlines. Cer sion to assessment ( of exercises). The lead sidered a declaration ts have obtained the e course of the seme sment into effect. Struct assessment in the cu t at a later date, struct ion to assessment a	ade via SB@home at the begin- he lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a cturer will inform students about of the course. Registration for the n of will to seek admission to as- e qualification for admission to ester, the lecturer will put their re- udents who meet all prerequisites urrent or in the subsequent seme- dents will have to obtain the qua- new.

#### Contents

Introduction to mathematical systems theory: stability, controllability and observability, state feedback and stability, basics in optimal control.

Recommended previous knowledge:

Basic knowledge of the contents of the module "Ordinary Differential Equations" is useful.

Intended learning outcomes

The student is acquainted with the fundamental notions and methods of control theory. He/She is able to establish a connection between these results and broader theories, and learns about the interactions of geometry and other fields of mathematics.

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

V +  $\ddot{U}$  (no information on SWS (weekly contact hours) and course language available)

**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. 90 to 120 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German or English

**Allocation of places** 

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#### Additional information

Workload

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

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# Module appears in

Bachelor' degree (1 major) Aerospace Computer Science (2009)

Bachelor' degree (1 major) Aerospace Computer Science (2011)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Module title					Abbreviation	
Stocha	Stochastical Processes 10-M=ASTP-102-m01					
Modul	e coord	inator		Module offered by		
Dean o	of Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
10	nume	rical grade		-		
Durati	on	Module level	Other prerequisites			
1 seme	ester	graduate	Registration for the	exercise must be ma	de via SB@home at the begin-	
			ning of the course o	r as announced by th	ne lecturer in accordance with	
			the specified registr	ation deadlines. Cer	tain prerequisites must be met	
			to qualify for admiss	sion to assessment (	e.g. successful completion of a	
			certain percentage of	of exercises). The lec	turer will inform students about	
			the respective detai	Is at the beginning o	f the course. Registration for the	
			exercise will be con	sidered a declaration	1 of will to seek admission to as-	
			assessment over the	e course of the seme	e qualification for admission to	
			gistration for assess	ment into effect Stu	idents who meet all prerequisites	
			will be admitted to a	assessment in the cu	urrent or in the subsequent seme-	
			ster. For assessmen	t at a later date. stud	dents will have to obtain the qua-	
			lification for admiss	ion to assessment a	new.	
Conter	nts		Ι			
Marko	v chains	s, queues, stochastic pro	ocesses in C[0,1], Brov	wnian motion, Donsk	ker's theorem, projective limits.	
Recom	mende	d previous knowledge:				
Basic I	knowled	lge of stochastics is requ	uired, such as that ac	quired in the "Stocha	astics 1" module. Knowledge of	
the co	ntents o	of the module "Stochasti	cs 2" is also recomme	ended.		
Intend	ed lear	ning outcomes				
The stu them t	udent is o practi	acquainted with the fur cal problems.	ndamental notions an	d methods of stocha	stical processes and can apply	
Course	<b>es</b> (type	, number of weekly cont	act hours, language –	- if other than Germa	n)	
V + Ü (	no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
<b>Metho</b> ster, ir	<b>d of ass</b> Iformati	sessment (type, scope, la ion on whether module o	anguage — if other tha an be chosen to earn:	an German, examina a bonus)	tion offered — if not every seme-	
At the	beginni	ng of the course, the lec	turer will choose one	of the following met	hods of assessment: a) written	
examii	nation (	90 to 120 minutes), b) o	ral examination of one	e candidate each (ap	prox. 20 minutes), c) oral exami-	
nation	in grou	ps (groups of 2, approx.	30 minutes)			
Allocat	tion of u		giisii			
			-			
Additional information						
Workload						
Teaching cycle						
Referr	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
Master's w (2012)	/ith 1 majo	r Computational Mathematics	JMU Würzburg • ge cord Master (120	enerated 26-Aug-2024 • exam ECTS) Computational Mather	n. reg. data re- natics - 2012	

# Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Master's with 1 major Computational Mathematics

(2012)

Module	e title				Abbreviation	
Topolo	Topology 10-M=ATOP-102-m01					
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	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Registration for the	exercise must be ma	de via SB@home at the begin-	
			ning of the course o	r as announced by tr	te lecturer in accordance with	
			to qualify for admiss	ation to assessment (	a g successful completion of a	
			certain percentage of	of exercises). The lec	turer will inform students about	
			the respective detai	ls at the beginning o	f the course. Registration for the	
			exercise will be con	sidered a declaratior	n of will to seek admission to as-	
			sessment. If student	ts have obtained the	qualification for admission to	
			assessment over the	e course of the seme	ster, the lecturer will put their re-	
			gistration for assess	sment into effect. Stu	idents who meet all prerequisites	
			will be admitted to a	assessment in the cu	irrent or in the subsequent seme-	
			ster. For assessmen	t at a later date, stuc	lents will have to obtain the qua-	
			lification for admiss	ion to assessment a	new.	
Conten	Its					
Set-the	eoretic 1	topology, topological inva ing spaces	ariants (e. g. fundame	ental group, connect	ion), construction of topological	
Intend	ed loar					
Tho stu	idont is	acquainted with the fun	damontal results the	oroms and mothods	in topology and is able to apply	
these t	o comn	non problems.	damentat results, the	orems and methods		
Course	s (type	, number of weekly conta	ct hours, language —	- if other than Germa	n)	
V + Ü (I	no infoi	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Metho	d of ass	sessment (type, scope, la	inguage — if other tha	an German, examina	tion offered — if not every seme-	
ster, in	formati	ion on whether module c	an be chosen to earn	a bonus)		
At the l	beginni	ng of the course, the lect	urer will choose one	of the following meth	hods of assessment: a) written	
examir nation	in grou	90 to 120 minutes), b) or $p_{12}(p_{12})$	al examination of one	e candidate each (ap	prox. 20 minutes), c) oral exami-	
Assess	ment o	ffered: Assessment offer	ed in the semester in	which the course is	offered and in the subsequent	
semes	ter, cou	rse offered on demand o	r every four semester	Ś.		
Langua	ige of a	ssessment: German, Eng	lish			
Allocat	ion of <sub>l</sub>	olaces				
Additional information						
Workload						
<u>-</u>						
Teaching cycle						
Referre	ed to in	LPOI (examination regu	lations for teaching-o	degree programmes)		

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Computational Mathematics - 2012

page 87 / 172

# Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module	Module title Abbreviation					
Numbe	r Theo	ry			10-M=AZTH-102-m01	
Module	o coord	instor		Module offered by	<u></u>	
Doan of	f Studi	os Mathomatik (Mathom	atics)	Institute of Mathem	atics	
FCTS	Meth	od of grading	Only after succ. con	nl. of module(s)	latics	
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate			Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-			
Conten	ts					
Numbe applica overvie Recomi Basic k	er-theor ations t w of th mende	retic functions and their a o prime number distribut e development of moder d previous knowledge: dge of algebra and numb	issociated Dirichlet s ion and diophantine n number theory. er theory is assumed	eries resp. Euler pro equations; discussi , such as can be acq	ducts, their analytic theory with on of the Riemann hypothesis, uired in the modules "Introducti-	
Intende			er meory and Appli	eu Algebia .		
Intended learning outcomes The student is acquainted with the fundamental methods of analytics number theory, can deal with algebraic structures in number theory and knows methods for the solution of diophantine equations. He/She has insight into modern developments in number theory.						
Course	<b>s</b> (type	, number of weekly conta	ict hours, language –	- if other than Germa	in)	
V + Ü (r	no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
<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)						
At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral exami- nation in groups (groups of 2, approx. 30 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.						

Language of assessment: German, English

# Allocation of places

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## Additional information

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# Workload

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

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# Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Module title					Abbreviation
Learning by Teaching Computational Mathematics 10-M=ELTCM-122-mo1					
Modul	e coord	inator		Module offered by	
Dean o	of Studio	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ester	graduate			
Conter	its				
Superv respec	vising a tive lec	tutorial or study group in turer.	applied mathematic	s in the Bachelor's p	programme under guidance of the
Intend	ed lear	ning outcomes			
The stu metho	udent g ds and	ains his/her first experier can apply them in practic	nce in teaching unive al situations.	rsity mathematics. H	le/She knows basic didactical
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
Ü (no i	nforma	tion on SWS (weekly cont	act hours) and cours	e language available	e)
Metho ster, in	<b>d of ass</b> formati	sessment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
practic Langua	al exan age of a	nination (approx. 90 minu ssessment: German, Eng	utes) lish		
Allocat	tion of p	olaces			
Additio	onal inf	ormation			
Workload					
Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Modul	Module appears in				
Master	's degr	ee (1 major) Computation	al Mathematics (201	2)	

Module title				Abbreviation	
Study	Study Group Mathematics in the Sciences				
Modul	e coord	inator		Module offered by	
Dean c	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate	Registration for the	seminar must be ma	de via SB@home at the begin-
			ning of the course o	r as announced by th	ne lecturer in accordance with the
			specified registratio	n deadlines. Some s	eminars or workshops might on-
			ly be open for stude	nts with previous kn	owledge and/or skills in certain
Carta			aleas. Where applic	able, details will be	
Conter	Its		•		
A mod	ern topi	c in mathematics in the s	sciences.		
Recom	mende	d previous knowledge:			
Basic k	nowled	lge from the modules "Or recommended, as well as	rdinary Differential Ec	juations" and "Introc functional analysis	duction to Partial Differential
Intend	ed lear	ning outcomes	s basic knowledge of	Tunctional analysis.	
The stu	ident g	ains insight into contemp	orary research proble	ems in mathematics	in the sciences. He/She masters
advand	ced tech	nniques in this field and o	can apply them to co	mplex problems.	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)
V + S (I	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Metho ster, in	<b>d of ass</b> formati	<b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
At the minar sentati of one Assess semes Langua	At the beginning of the course, the lecturer will choose one or two of the following methods of assessment: a) se- minar presentation (approx. 60 to 120 minutes), b) written elaboration of contents equivalent to a seminar pre- sentation of approx. 60 to 120 minutes, c) written examination (approx. 90 to 120 minutes), d) oral examination of one candidate each (approx. 20 minutes), e) oral examination in groups of 2 candidates (approx. 30 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.				
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
Workload					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Modul	e appea	nrs in			
Master	's degr	ee (1 major) Mathematics	6 (2012) D Physics (2012)		
Master	s uegn 's degr	ee (1 major) Mathematica	al Mathematics (2012)	2)	
musici					

Module title					Abbreviation
Study	Study Group Numerical Mathematics and Applied Analysis				
Modul	e coord	inator		Module offered by	
Dean c	of Studio	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ester	graduate	Registration for the	seminar must be ma	de via SB@home at the begin-
			ning of the course of	r as announced by tr	ie lecturer in accordance with the
			specified registratio	n deadlines. Some s	eminars of workshops might on-
			areas Where applic	able details will be	specified in the class schedule
Conter	nts		areas. where applied		
Select	ed tonic	s in numerical mathemat	tics applied analysis	or scientific comput	ing
Selecti	eu topic		lics, applied analysis	or scientific comput	.ing.
Recom	mende	d previous knowledge:			
Depen	ding on	the content, basic and a	dvanced knowledge	from different areas	of analysis and/or numerical ma-
thema	tics is re	equired. In case of doubt	, it is recommended t	o consult the lecture	۲ <b>.</b>
Intend	ed lear			1	
The Sti He/Sh	ident ga e maste	ains insignt into a conten ers advanced techniques	nporary research prot in this field and can ;	plems in numerical n apply them to compl	nathematics or applied analysis.
Course		number of weekly conta	ct hours language -	if other than Germa	n)
	no infor	mation on SWS (wookly c	contact hours) and co		
V + 3 (	doface		nguage if other the	on Corman, ovamina	tion offered if not even some
ster, in	Iformati	on on whether module ca	an be chosen to earn	a bonus)	tion onered — It not every seme-
At the	beginni	ng of the course, the lect	urer will choose one	or two of the followin	ng methods of assessment: a) se-
minar	present	ation (approx. 60 to 120 )	minutes), b) written e	elaboration of conter	o minutes) d) oral examination
of one	candid	ate each (approx. 20 min	utes), e) oral examination	ation in groups (grou	ips of 2, approx. 30 minutes)
Langua	age of a	ssessment: German, Eng	lish		
Alloca	tion of p	olaces			
Additio	onal inf	ormation			
	_				
Worklo	ad				
Teachi	Teaching cycle				
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
Master's degree (1 major) Mathematics (2012)					
Master	Master's degree (1 major) Mathematics (2010)				
Master	's degr	ee (1 major) Economathe	matics (2011)		
Master	r's degr	ee (1 major) Mathematica	al Physics (2012)	2)	
master	Master's degree (1 major) Computational Mathematics (2012)				

Master's with 1 major Computational Mathematics	JMU Würzburg • generated 26-Aug-2024 • exam. reg. data re-
(2012)	cord Master (120 ECTS) Computational Mathematics - 2012

Modul	e title				Abbreviation	
Study	Study Group Robotic, Optimization and Control Theory 10-M=GROK-102-mo1					
Modul	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Registration for the	seminar must be ma	de via SB@home at the begin-	
			ning of the course o	r as announced by th	ie lecturer in accordance with the	
			specified registratio	n deadlines. Some s	eminars or workshops might on-	
			ly be open for stude	nts with previous kn	owledge and/or skills in certain	
<u> </u>			aleas. Where applic	able, details will be	specified in the class schedule.	
Conter	Its					
Selecte	ed mod	ern topics in robotics, op	timisation and contro	ol theory.		
Recom Knowle	mende edge of	d previous knowledge: the contents of the modu	ule "Mathematical Co	ntrol Theory" or "Cor	ntrol Theory" is required.	
Intend	ed lear	ning outcomes		,	2	
The stu	ident g	ains insight into contemp	orary research proble	ems in robotics, opti	mization and control theory. He/	
She ma	asters a	dvanced techniques in t	his field and can app	ly them to complex p	problems.	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
V + S (I	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Metho ster, in	<b>d of ass</b> formati	s <b>essment</b> (type, scope, la on on whether module ca	inguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
At the minar p sentati of one Langua	beginni oresent on of a candid age of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 120 minutes ate each (approx. 20 min ssessment: German, Eng	urer will choose one minutes), b) written e , c) written examinati utes), e) oral examina lish	or two of the followin elaboration of conter ion (approx. 90 to 12 ation in groups (grou	ng methods of assessment: a) se- nts equivalent to a seminar pre- o minutes), d) oral examination nps of 2, approx. 30 minutes)	
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Teaching cycle						
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Master	Master's degree (1 major) Mathematics (2012)					
Master	's degr	ee (1 major) Mathematics	5 (2010)			
Master	's degr	ee (1 major) Economathe	matics (2011)			
Master	's degr	ee (1 major) Mathematica	al Physics (2012)	2)		
master	Master's degree (1 major) Computational Mathematics (2012)					

Master's with	1 major Computational Mathematics
(2012)	.,

Module title					Abbreviation
Master Thesis Computational Mathematics					10-M=MACM-102-m01
Module	Module coordinator M				
Dean o	f Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
30	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Registration for asse	essment and assignr	nent of topic in consultation with
			supervisor. The supe	ervisor may make the	e successful completion of cer-
			tain modules that ar	e relevant for the res	spective topic a prerequisite for
			the assignment of th	ie topic.	
Conten	ts				
Indepe	ndently	researching and writing	on a topic in mathem	natics selected in co	nsultation with the supervisor.
Intende	ed learı	ning outcomes			
The stu tained	dent is during	able to work independen his/her studies in the ma	ntly on a given mathe aster programme. He/	matical topic and ap She can write down	oply the skills and methods ob- the result of his/her work in a
suitable	e form.				
Course	<b>s</b> (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
no cou	ses as	signed			
Method ster, inf	<b>l of ass</b> formati	s <b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
written	thesis				
Langua	ge of a	ssessment: German, Eng	lish		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module	appea	irs in			
Master	s degr	ee (1 major) Computation	al Mathematics (201	2)	

Module title		Abbreviation		
Giovanni-Prod	li Seminar (Master)		10-M=SGPC-102-m01	
Module coord	inator		Module offered by	
Dean of Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS Metho	od of grading	Only after succ. com	pl. of module(s)	
5 nume	rical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	Registration for the s ning of the course of specified registratio ly be open for stude areas. Where applic	seminar must be ma r as announced by th n deadlines. Some s nts with previous kn able, details will be	de via SB@home at the begin- ne lecturer in accordance with the eminars or workshops might on- owledge and/or skills in certain specified in the class schedule.
Contents		<u>, , , , , , , , , , , , , , , , , , , </u>		
A modern topi	c in the research expertis	se of the current hold	er of the Giovanni Pr	odi Chair.
Intended lear	ning outcomes			
The student is the topic and	able to elaborate a cont the available literature, p	emporary research to preparing a talk and th	pic. This includes co ne ability to participa	mprehending and structuring of ate in a scientific discussion.
Courses (type,	, number of weekly conta	ict hours, language —	· if other than Germa	n)
S (no informat	ion on SWS (weekly cont	act hours) and cours	e language available	e)
Method of ass ster, informati	s <b>essment</b> (type, scope, la on on whether module c	inguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
At the beginni minar present sentation of a Language of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 90 minutes ssessment: English, Gen	urer will choose one ( minutes), b) written e man if agreed upon w	or two of the followin laboration of conter ith the examiner	ng methods of assessment: a) se- nts equivalent to a seminar pre-
Allocation of p	olaces	· · · · · · · · · · · · · · · · · · ·		
Additional info	ormation			
Workload				
Teaching cycl	e			
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)				
Module appears in				
Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)				

Module title					Abbreviation
Interdisciplinary Seminar					10-M=SIDZ-102-m01
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate	Registration for the s ning of the course of specified registratio ly be open for stude areas. Where applica	Registration for the seminar must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Some seminars or workshops might on- ly be open for students with previous knowledge and/or skills in certain areas. Where applicable, details will be specified in the class schedule	
Conten	Its				
A mode	ern topi	c in mathematics with in	terdisciplinary aspect	ts.	
Intend	ed lear	ning outcomes			
The stu the top	ident is	able to elaborate a cont the available literature, p	emporary research to preparing a talk and th	pic. This includes co ne ability to participa	mprehending and structuring of ate in a scientific discussion.
Course	<b>s</b> (type	, number of weekly conta	ict hours, language —	if other than Germa	n)
S (no ir	nformat	ion on SWS (weekly cont	act hours) and cours	e language available	)
Metho ster, in	<b>d of ass</b> formati	<b>essment</b> (type, scope, la on on whether module c	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
At the l minar p sentati Langua	beginni present on of a age of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 90 minutes ssessment: German, Eng	urer will choose one ( minutes), b) written e (lish	or two of the followir laboration of conter	ng methods of assessment: a) se- Its equivalent to a seminar pre-
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
Worklo	ad		·		
<b>Referred to in IPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
Master's degree (1 major) Mathematics (2012)					
Master	's degr	ee (1 major) Mathematics	5 (2010)		
Master	's degr	ee (1 major) Economathe	matics (2011)		
Master	's degr	ee (1 major) Mathematica	al Physics (2012)	\`	
Master	Master's degree (1 major) Computational Mathematics (2012)				

Module title					Abbreviation
Seminar in Mathematics in the Sciences 10-M=SMNW-122-mo1					
Module	coord	inator		Module offered by	
Dean of	Studie	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	numei	rical grade			
Duration	1	Module level	Other prerequisites		
1 semes	ter	graduate	Registration for the	seminar must be ma	de via SB@home at the begin-
			ning of the course o	r as announced by th	ne lecturer in accordance with the
			specified registratio	n deadlines. Some s	eminars or workshops might on-
			ly be open for stude	nts with previous kn	owledge and/or skills in certain
			areas. where applic	able, details will be	specified in the class schedule.
Content	5				
A moder	rn topi	c in mathematics in the s	sciences.		
Recomm	nende	d previous knowledge:			
Basic kn Equation	nowled	lge from the modules "Or recommended, as well as	dinary Differential Ec s basic knowledge of	juations" and "Introc functional analysis.	luction to Partial Differential
Intende	d learr	ning outcomes			
The stuc	lent is	able to elaborate a conte	emporary research to reparing a talk and th	pic. This includes co he ability to participa	mprehending and structuring of a scientific discussion.
Courses	(type	number of weekly conta	ct hours, language –	if other than Germa	n)
S (no inf	format	ion on SWS (weekly cont	act hours) and cours	e language available	) )
Method	ofass	essment (type scope la	nguage — if other th	an German examina	tion offered — if not every seme-
ster, info	ormati	on on whether module ca	an be chosen to earn	a bonus)	tion oncica in not every senie
At the be minar pr	eginni resenta	ng of the course, the lect ation (approx. 60 to 120 i	urer will choose one minutes), b) written e	or two of the followir elaboration of conter	ng methods of assessment: a) se- nts equivalent to a seminar pre-
sentatio	n of a	pprox. 60 to 90 minutes			
Assessn	nent o	ffered: Assessment offere	ed in the semester in	which the course is	offered and in the subsequent
Semeste	er, cou re of a	rse offered on demand o ssessment: German, Eng	r every four semester lish	5.	
Allocatio	on of r				
Allocatio		haces			
Addition	al inf	ormation			
Workloa	ıd				
Teaching cycle					
Referred	<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)				
Module appears in					
Master's	s degre	ee (1 major) Mathematics	(2012)		
Master's	s degre	ee (1 major) Mathematica	ll Physics (2012)		
Master's	Master's degree (1 major) Computational Mathematics (2012)				

Modul	Module title				Abbreviation
Semina	Seminar in Numerical Mathematics and Applied Analysis				
Modul	e coord	inator		Module offered by	
Dean c	of Studio	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ester	graduate	Registration for the	seminar must be ma	de via SB@home at the begin-
			ning of the course o	r as announced by th	ne lecturer in accordance with the
			specified registratio	n deadlines. Some s	eminars or workshops might on-
			ly be open for stude	nts with previous kn	owledge and/or skills in certain
<u> </u>				able, details will be	
Conter	its				
A mod	ern topi	c in numerical mathemat	lics or applied analys	IS.	
Recom	mende	d previous knowledge:			
Depen	ding on	the content, basic and a	dvanced knowledge	from different areas	of analysis and/or numerical ma-
thema	tics is re	equired. In case of doubt	, it is recommended t	o consult the lecture	er.
Intend	ed lear	ning outcomes			
The stu the top	udent is bic and	able to elaborate a cont the available literature, p	emporary research to reparing a talk and tl	pic. This includes co he ability to participa	mprehending and structuring of ate in a scientific discussion.
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)
S (no i	nformat	ion on SWS (weekly cont	act hours) and cours	e language available	2)
<b>Metho</b> ster, in	<b>d of ass</b> formati	<b>essment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
At the minar sentati Langua	beginni present ion of a age of a	ng of the course, the lect ation (approx. 60 to 120 pprox. 60 to 90 minutes ssessment: German, Eng	urer will choose one minutes), b) written e lish	or two of the followir elaboration of conter	ng methods of assessment: a) se- nts equivalent to a seminar pre-
Allocat	tion of p	olaces			
Additio	onal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
Master	Master's degree (1 major) Mathematics (2012)				
Master	Master's degree (1 major) Mathematics (2010)				
Master	's degr	ee (1 major) Economathe	matics (2011)		
Master	's degr	ee (1 major) Mathematica	l Physics (2012)	-)	
Master	Master's degree (1 major) Computational Mathematics (2012)				

Master's with 1	I major Computational Mathematics
(2012)	

Module title				Abbreviation	
Semina	ar in Op	otimization			10-M=SOPT-102-m01
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS Method of grading			Only after succ. con	npl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate	Registration for the	seminar must be ma	de via SB@home at the begin-
			ning of the course o	r as announced by th	ne lecturer in accordance with the
			specified registratio	n deadlines. Some s	eminars or workshops might on-
			ly be open for stude	nts with previous kn	owledge and/or skills in certain
			areas. Where applic	able, details will be	specified in the class schedule.
Conten	ts				
A mode	ern topi	ic in optimisation.			
Intend	ed lear	ning outcomes			
The stu the top	ident is ic and	able to elaborate a conte the available literature, p	emporary research to reparing a talk and t	pic. This includes co he ability to participa	mprehending and structuring of ate in a scientific discussion.
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)
S (no ir	nformat	tion on SWS (weekly cont	act hours) and cours	e language available	2)
Metho	d of ass	sessment (type, scope, la	nguage — if other th	an German, examina	tion offered — if not every seme-
ster, in	formati	ion on whether module ca	an be chosen to earn	a bonus)	
At the l	oeginni	ng of the course, the lect	urer will choose one	or two of the followir	ng methods of assessment: a) se-
minar p	present	ation (approx. 60 to 120	minutes), b) written e	elaboration of conter	nts equivalent to a seminar pre-
sentati	on of a	pprox. 60 to 90 minutes			fformed and in the such as such as
Assess	ment o	rrefea: Assessment offer urse offered on demand o	ea in the semester in r every four semester	which the course is	onered and in the subsequent
Langua	ige of a	ssessment: German, Eng	lish	5.	
Allocat	ion of I	olaces			
Additio	nal inf	ormation			
Additio	inac init				
Worklo	ad				
WOIKIO	au				
 Toachi		0			
	ig cyci	e			
Referre	d to in	IPOI (examination regu	lations for teaching.	legree programmes)	
Module appears in					
Master	Master's degree (1 major) Mathematics (2012)				
Master	Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010)				
Master	's degr	ee (1 major) Economathe	matics (2011)		
Master	's degr	ee (1 major) Mathematica	al Physics (2012)		
Master	's degr	ee (1 major) Computation	al Mathematics (201	2)	

Module title					Abbreviation		
Select	ed Topi	cs in Analysis			10-M=VANA-122-m	01	
Module coordinator			Module offered by				
Dean of Studies Mathematik (Mathemati			matics)	itics) Institute of Mathematics			
ECTS	Meth	od of grading	Only after succ. compl. of module(s)				
10	nume	rical grade					
Duration Module level			Other prerequisites				
1 semester		graduate	Certain prerequisite	s must be met to qua	alify for admission to	o as-	
			sessment. The lectu	nts about the respe	ctive details		
			at the beginning of the course. Registration for the course will be con-				
			dents have obtained	sidered a declaration of will to seek admission to assessment. If stu-			
			the course of the semester, the lecturer will put their registration for as-				
			sessment into effect	sessment into effect. Students who meet all prerequisites will be admit-			
			ted to assessment i	ted to assessment in the current or in the subsequent semester. For as-			
			sessment at a later	sessment at a later date, students will have to obtain the qualification for			
			admission to assess	sment anew.			
Conter	nts						
In-depth discussion of a specialised topic in analysis taking into account recent developments and interrelations with other mathematical concepts.					interrelations		
Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of analysis is required. In case of doubt, it is recommended to consult the lecturer.							
Intend	ed lear	ning outcomes					
The stu comple	udent is ex prob	acquainted with adva lems.	nced results in a select	ed topic in analysis,	and is able to apply	these to	
Course	<b>es</b> (type	, number of weekly cor	itact hours, language –	- if other than Germa	n)		
V + Ü (	no info	rmation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
Metho ster, in	<b>d of as</b> format	sessment (type, scope, ion on whether module	language — if other the can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
At the examin minute Assess semes Langua	beginni nation ( es), c) o sment o ter, cou age of a	ng of the course, the le approx. 90 to 120 minu ral examination in grou ffered: Assessment off ırse offered on demand ssessment: German, E	ecturer will choose one ites; usually chosen), b ups of 2 candidates (ap ered in the semester in or every four semester nglish	of the following meth ) oral examination o prox. 30 minutes tota which the course is s.	nods of assessment f one candidate eac al) offered and in the s	: a) written h (approx. 20 ubsequent	
Allocat	tion of <sub>l</sub>	olaces					
Additio	onal inf	ormation					
Worklo	bad						
Teaching cycle							
Referre	ed to in	LPOI (examination re	gulations for teaching-	degree programmes)			
Master's with 1 major Computational Mathematics JMU Würzburg • generated 26-Aug-2024 • exam. reg. data re- (2012) cord Master (120 ECTS) Computational Mathematics - 2012				page 101 / 172			

# Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module title				Abbreviation			
Dynam	nical Sy	stems and Control			10-M=VDSR-102-m	01	
Module coordinator				Module offered by	<u>.</u>		
Dean of Studies Mathematik (Mathema			matics)	cs) Institute of Mathematics			
ECTS	Meth	od of grading	Only after succ. compl. of module(s)				
5 numerical grade							
Duration Module level			Other prerequisites	Other prerequisites			
1 semester		graduate	Registration for the ning of the course o	exercise must be ma or as announced by tl	ide via SB@home at ne lecturer in accord	the begin- ance with	
			the specified regist	the specified registration deadlines. Certain prerequisites must be met			
			to qualify for admission to assessment (e.g. successful completion of a				
			certain percentage	certain percentage of exercises). The lecturer will inform students about			
			the respective detai	ils at the beginning o	of the course. Registr	ation for the	
			exercise will be con	sidered a declaration	n of will to seek adm	ission to as-	
			sessment. If studen	sessment. If students have obtained the qualification for admission to			
			assessment over th	assessment over the course of the semester, the lecturer will put their re-			
			gistration for assess	sment into effect. Su	utents who meet all	prerequisites	
			ster For assessmen	ut at a later date stur	dents will have to ob	tain the qua-	
			lification for admiss	ion to assessment a	new	tain the qua-	
Contor				son to assessment a			
Basics stems; ted cor	in dyna selecte mmunio	amical systems and co ed advanced topics, e. cation, entropy of dyna	ntrol: non-linear dynam g. networked dynamica mical systems.	iics, stability theory, al systems, non-linea	ergodic theory, Ham ar stability, dynamics	iltonian sy- s with restric-	
Recom Basic I	mende knowled	d previous knowledge: lge of the contents of t	he module "Ordinary D	ifferential Equations	" is useful.		
Intend	ed lear	ning outcomes					
The stu analys	udent m e their (	nasters the mathemation	cal methods in the theo	ry of dynamic systen	ns and control, and i	s able to	
Course	es (type	, number of weekly cor	ntact hours, language –	- if other than Germa	ın)		
V + Ü (	no info	mation on SWS (week	ly contact hours) and co	ourse language avail	able)		
Metho ster, in	<b>d of as</b> format	sessment (type, scope, ion on whether module	, language — if other th e can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
At the examir nation Assess semes Langua	beginni nation ( in grou sment o ter, cou age of a	ng of the course, the le 60 to 90 minutes), b) o ps (groups of 2, appro ffered: Assessment off rse offered on demand ssessment: German, E	ecturer will choose one oral examination of one x. 20 minutes) Fered in the semester in d or every four semester nglish	of the following met candidate each (app which the course is rs.	hods of assessment prox. 15 minutes), c) offered and in the s	: a) written oral exami- ubsequent	
Allocation of places							
Additio	onal inf	ormation					
worklo	Jad						
	_						
Master's w	/ith 1 maio	r Computational Mathematics	IMU Würzburg • 9	enerated 26-Aug-2024 • exam	n. reg. data re-	page 103 / 172	
(2012)		parational mathematics	cord Master (120	ECTS) Computational Mather	matics - 2012	page 1057 172	

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

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Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Module	e title				Abbreviation	
Groups and their Representations					10-M=VGDS-102-m01	
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathem			atics)	Institute of Mathematics		
ECTS	CTS Method of grading		Only after succ. compl. of module(s)			
10	nume	rical grade				
Duration Module level		Other prerequisites				
1 seme	ster	graduate	Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme ster. For assessment at a later date, students will have to obtain the qua-			
Conten	Its					

Finite permutation groups and character theory of finite groups, interrelations and special techniques such as the S-rings of Schur.

Recommended previous knowledge:

Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".

#### Intended learning outcomes

The student masters advanced algebraic concepts and methods. He/She gains the ability to work on contemporary research questions in group theory and representation theory and can apply his/her skills to complex problems.

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

V + Ü (no information on SWS (weekly contact hours) and course language available)

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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (approx. 90 to 120 minutes; usually chosen), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups of 2 candidates (approx. 30 minutes total)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

**Additional information** 

Workload

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

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# Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Mathematical Physics (2012)

Module title				Abbreviation		
Giovanni-Prodi Lecture Selected Topics (Master) 10-M=VGPC-122-m01						
Module coordinator				Module offered by	<u> </u>	
Dean of Studies Mathematik (Mathema			atics) Institute of Mathematics		atics	
FCTS	Meth	nd of grading	Only after succ. com	nl. of module(s)		
10	nume	rical grade				
Duratio	n n	Module level	Other prerequisites			
1 seme	ster	graduate	Certain prerequisite	s must be met to au	alify for admission to as-	
1 Semester		0	sessment. The lecturer will inform students about the respective details			
			at the beginning of t	he course. Registrat	ion for the course will be con-	
			sidered a declaration of will to seek admission to assessment. If stu-			
			dents have obtained	d the qualification fo	r admission to assessment over	
			the course of the se	mester, the lecturer	will put their registration for as-	
			sessment into effect. Students who meet all prerequisites will be admit-			
			ted to assessment in	n the current or in th	e subsequent semester. For as-	
			sessment at a later	date, students will h	ave to obtain the qualification for	
			admission to assess	sment anew.		
Conten	Its					
Introdu	uction to	o a specialised topic in m	nathematics by an int	ernational expert.		
Intend	ed lear	ning outcomes				
The stu	udent is	acquainted with the fun	damental concepts a	nd methods of a cor	temporary research topic in ma-	
themat	tics. He	/She is able to establish	a connection betwee	n his/her acquired s	kills and other branches of ma-	
themat	tics and	l applications in other su	bjects.			
Course	<b>s</b> (type	, number of weekly conta	ect hours, language —	- if other than Germa	n)	
V + Ü (no information on SWS (weekly contact hours) and course language available)						
<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)						
At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (approx. 90 to 120 minutes; usually chosen), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups of 2 candidates (approx. 30 minutes total) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.						
Language of assessment: English, German if agreed upon with the examiner						
Allocation of places						
Additio	onal inf	ormation				
			-			
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematical Physics (2012)						

Master's with 1 major Computational Mathematics	Ì
(2012)	


Module title				Abbreviation		
Mather	matical	Continuum Mechanic	S		10-M=VKOM-122-m	01
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathematics) Institute of Mathematics						
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Certain prerequisite	s must be met to qua	alify for admission to	o as-
			sessment. The lectu	rer will inform stude	nts about the respec	ctive details
			at the beginning of t	he course. Registrat	ion for the course wi	ll be con-
			sidered a declaratio	n of will to seek adm	ission to assessme	nt. If stu-
			dents have obtained	the qualification to	r admission to asses	ssment over
			the course of the se	mester, the lecturer	will put their registra	ition for as-
			sessment into effect	t. Students who mee	t all prerequisites w	III DE admit-
				data, students will b	e subsequent series	alification for
			admission to accose	ale, students will in	ave to obtain the qu	alification for
		<u> </u>				
Conten	ts					
Partial	differei	ntial equations and/or	variational methods in	the context of contin	nuum mechanics.	
Recom Basic k Equatic	mende nowled ons" is	d previous knowledge dge from the modules recommended, as wel	: 'Ordinary Differential Ec l as basic knowledge of	quations" and "Introc functional analysis.	duction to Partial Dif	ferential
Intende	ed lear	ning outcomes				
The stu main fi	ident m elds of	asters the mathemation application.	cal methods in mathem	atical continuum me	chanics and knows	about their
Course	<b>s</b> (type	, number of weekly co	ntact hours, language –	- if other than Germa	n)	
V + Ü (r	no infoi	rmation on SWS (week	ly contact hours) and co	ourse language avail	able)	
Methoo ster, inf	<b>d of ass</b> formati	sessment (type, scope ion on whether module	, language — if other tha e can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
At the b examin nation Assess semest	At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.					
Langua	ige of a	ssessment: German, E	nglish			
Allocat	ion of p	olaces				
 Additio	nalinf	ormation				
Workload						
Teaching cycle						
Referre	<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
······································						
Module	e appea	ars in				
Master's wi	ith 1 majo	r Computational Mathematics	JMU Würzburg • ge	enerated 26-Aug-2024 • exam	n. reg. data re-	page 109 / 172
(2012)			cord Master (120	ECIS) Computational Mather	natics - 2012	

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module title Abbreviation						
Mathe	matical	Imaging			10-M=VMBV-102-m01	
Modul	Module coordinator			Module offered by		
Dean o	f Studi	es Mathematik (Mathe	matics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
Duration   Module level     1 semester   graduate     1 semester   graduate     Semester   graduate     Mathematical fundamentals of image procession of image proc			Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be con sessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessmen lification for admiss	Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua- lification for admission to assessment anew.		
Recom Basic k ded. Intende	mende mowled	d previous knowledge: dge of functional analy ning outcomes	sis, such as that taught	in the module "Fund	ctional Analysis", is recommen-	
fields o	of appli	cation.	al methods in the theo	ry of image processi	ng and knows about their main	
Course	<b>s</b> (type	, number of weekly cor	itact hours, language –	- if other than Germa	an)	
V + Ü (I	no infoi	rmation on SWS (week	y contact hours) and co	ourse language avail	able)	
Metho ster, in	<b>d of ass</b> formati	sessment (type, scope, ion on whether module	language — if other the can be chosen to earn	an German, examina a bonus)	ation offered — if not every seme-	
At the l examir nation Langua	beginni nation ( in grou age of a	ng of the course, the le 60 to 90 minutes), b) o ps (groups of 2, appro ssessment: German, E	ecturer will choose one ral examination of one k. 20 minutes) nglish	of the following met candidate each (app	hods of assessment: a) written prox. 15 minutes), c) oral exami-	
Allocat	ion of <sub>l</sub>	olaces				
Additio	Additional information					
Worklo	Workload					
Teachi	ng cycl	e				

## Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module title					Abbreviation
Selecte	ed Topi	cs in Mathematical Phys	ics		10-M=VMPH-102-m01
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	atics
ECTS	Methe	od of grading	Only after succ. con	npl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate	Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be con- sessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessmen lification for admiss	exercise must be ma r as announced by the ration deadlines. Cer sion to assessment ( of exercises). The lec ls at the beginning of sidered a declaration ts have obtained the e course of the seme sment into effect. Stu assessment in the cu t at a later date, stud ion to assessment a	de via SB@home at the begin- ne lecturer in accordance with tain prerequisites must be met e. g. successful completion of a turer will inform students about f the course. Registration for the n of will to seek admission to as- e qualification for admission to ester, the lecturer will put their re- idents who meet all prerequisites irrent or in the subsequent seme- dents will have to obtain the qua- new.
Conten	te				

Selected topics in mathematical physics (e.g. differential equations of mathematical physics, probability theory, hydrodynamics, hyperbolic conservation equations, mathematical materials science, quantum mechanics).

Recommended previous knowledge:

Depending on the content, basic and advanced knowledge from different areas of analysis is required. In case of doubt, it is recommended to consult the lecturer.

#### Intended learning outcomes

The student is acquainted with advanced results in a field in mathematical physics. He/She knows mathematical methods in mathematical physics and can apply them to solve problems in physics.

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

V + Ü (no information on SWS (weekly contact hours) and course language available)

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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

Allocation of places

## **Additional information**

Workload

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

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# Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Computational Mathematics (2012)

Module title					Abbreviation		
Non-Li	Non-Linear Analysis 10-M=VNAN-102-m01						
Modul	e coord	inator		Module offered by	d by		
Dean c	of Studi	es Mathematik (Mathema	atics)	Institute of Mathematics			
ECTS	5 Method of grading Only after succ. compl. of module(			npl. of module(s)			
5	nume	rical grade		1			
Durati	on	Module level	Other prerequisites				
1 seme	ester	graduate	Registration for the	exercise must be ma	de via SB@home at the begin-		
			ning of the course o	r as announced by th	ne lecturer in accordance with		
			the specified registr	ation deadlines. Cer	tain prerequisites must be met		
			to qualify for admiss	sion to assessment (	e.g. successful completion of a		
			certain percentage o	of exercises). The lec	turer will inform students about		
			the respective detai	Is at the beginning o	of the course. Registration for the		
			exercise will be con	sidered a declaration	n of will to seek admission to as-		
			sessment. If studen	ts nave obtained the	qualification for admission to		
			distration for accoss	mont into offect. Stu	idents who most all proroquisitos		
			will be admitted to a	assessment in the cu	urrent or in the subsequent seme-		
			ster. For assessmen	t at a later date, stud	lents will have to obtain the qua-		
			lification for admiss	ion to assessment a	new.		
Conter	nts		ļ				
Metho	ds in no	onlinear analysis (e. g. to	pological methods, m	nonotony and variati	onal methods) with applications.		
Deserve		d					
We rec	ommer	d previous knowledge: Id basic knowledge of fu	nctional analysis and	partial differential e	quations, such as can be acqui-		
red in	the mod	dules "Introduction to Fu	nctional Analysis" and	d "Applied Analysis"			
Intend	ed lear	ning outcomes					
The stu bility o	udent is n pract	acquainted with the cor ical problems.	ncepts of non-linear a	nalysis, can compar	e them and assess their applica-		
Course	<b>es</b> (type	, number of weekly conta	act hours, language –	- if other than Germa	n)		
V + Ü (	no infoi	mation on SWS (weekly	contact hours) and co	ourse language avail	able)		
<b>Metho</b> ster, in	<b>d of ass</b> Iformati	<b>sessment</b> (type, scope, la on on whether module c	anguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
At the	beginni	ng of the course, the lect	turer will choose one	of the following met	hods of assessment: a) written		
examir	nation (	60 to 90 minutes), b) ora	l examination of one	candidate each (app	prox. 15 minutes), c) oral exami-		
nation	in grou	ps (groups of 2, approx.	20 minutes)				
Allocat	tion of i	ssessment: German, Eng	511511				
Additio	onal inf	ormation					
Workload							
Teaching cycle							
Referre	<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Master's w	ith 1 majo	r Computational Mathematics	JMU Würzburg • ge	enerated 26-Aug-2024 • exam	n. reg. data re- page 115 / 172		
(2012)			cord Master (120	ECTS) Computational Mather	natics - 2012		

# Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module	e title				Abbreviation	
Numer	ic of Pa	rtial Differential Equatio	ns		10-M=VNPE-102-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
DurationModule levelOther prerequisites1 semestergraduateRegistration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance wit the specified registration deadlines. Certain prerequisites must be made via Qualify for admission to assessment (e.g. successful completion of certain percentage of exercises). The lecturer will inform students ab the respective details at the beginning of the course. Registration for exercise will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission assessment over the course of the semester, the lecturer will put the gistration for assessment into effect. Students who meet all prerequi will be admitted to assessment in the current or in the subsequent setter. For assessment at a later date, students will have to obtain the lification for admission to assessment anew.ContentsTypes of partial differential equations, qualitative properties, finite differences, finite elements, error estimar (numerical methods for elliptic, parabolic and hyperbolic partial differential equations; finite elements meth					ide via SB@home at the begin- he lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a sturer will inform students about of the course. Registration for the n of will to seek admission to as- e qualification for admission to ester, the lecturer will put their re- udents who meet all prerequisites urrent or in the subsequent seme- dents will have to obtain the qua- new. finite elements, error estimates tations; finite elements method,	
Recom We rec red in t	mende ommer he moo	d previous knowledge: Id basic knowledge of fui dules "Introduction to Fui <b>ning outcomes</b>	nctional analysis and nctional Analysis" and	partial differential e d "Applied Analysis"	equations, such as can be acqui-	
The stu	udent is	acquainted with advanc	ed methods for discr	etising partial differe	ential equations.	
Course	<b>s</b> (type	, number of weekly conta	act hours, language –	- if other than Germa	in)	
V + Ü (I	no infoi	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Metho ster, in	<b>d of ass</b> formati	<b>sessment</b> (type, scope, la ion on whether module c	anguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral exami- nation in groups (groups of 2, approx. 30 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters. Language of assessment: German, English						
Allocation of places						
Additional information						
Workload						

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

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# Module appears in

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) Economathematics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Computational Mathematics (2012)

Module title					Abbreviation		
Selected Topics in Optimization					10-M=VOPT-102-m	01	
Modul	e coord	inator		Module offered by	<u> </u>		
Dean	of Studi	es Mathematik (Mathe	matics)	Institute of Mathem	atics		
ECTS	Meth	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
10	nume	rical grade					
Duratio	on	Module level	Other prerequisites	i			
1 seme	ester	graduate	Registration for the	exercise must be ma	de via SB@home at	the begin-	
			ning of the course o	or as announced by th	ne lecturer in accord	ance with	
			the specified regist	ration deadlines. Cer	tain prerequisites m	ust be met	
			to qualify for admis	sion to assessment (	e.g. successful com	pletion of a	
			certain percentage	of exercises). The lec	turer will inform stud	dents about	
			the respective detai	ils at the beginning o	f the course. Registr	ation for the	
			exercise will be con	sidered a declaration	n of will to seek adm	ission to as-	
			sessment. If studen	ts have obtained the	e qualification for adi	mission to	
			assessment over th	e course of the seme	ster, the lecturer will	i put their re-	
			will be admitted to	assassment in the cu	urent or in the subse	prerequisites	
			ster For assessmen	it at a later date stur	lents will have to oh	tain the qua-	
			lification for admiss	ion to assessment a	new.	tum the quu	
Conter	nte	<u> </u>					
Selecto	ed toni	s in ontimization e g	inner point methods	semidefinite program	s non-smooth ontir	mization ga.	
me the	eory, op	timization with differen	ntial equations.	semidemite program		1112011011, 50	
Intend	ed lear	ning outcomes					
The stu	udent is	acquainted with adva	nced methods in contir	nuous optimization.	He gains the ability t	o work on	
conten	nporary	research questions in	continuous optimizatio	on.			
Course	<b>es</b> (type	, number of weekly con	ntact hours, language –	- if other than Germa	n)		
V + Ü (	no info	rmation on SWS (week	ly contact hours) and co	ourse language avail	able)		
Metho ster, in	<b>d of as:</b> Iformat	sessment (type, scope ion on whether module	, language — if other th e can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
At the	beginni	ing of the course, the l	ecturer will choose one	of the following met	hods of assessment	: a) written	
examir	nation (	90 to 120 minutes), b)	oral examination of one	e candidate each (ap	prox. 20 minutes), c	:) oral exami-	
Langua	age of a	issessment: German, E	nglish				
Allocat	tion of	places					
			N. Contraction of the second sec				
Additio	onal inf	ormation					
Worklo	bad						
Teaching cycle							
Referre	<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Modul	Module appears in						
Master	r's degr	ee (1 major) Mathemat	ics (2012)				
Master's w	/ith 1 majo	r Computational Mathematics	JMU Würzburg • go	enerated 26-Aug-2024 • exan	n. reg. data re-	page 119 / 172	
(2012)			cord Master (120	ECTS) Computational Mather	matics - 2012		



Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Computational Mathematics (2012)

Module title					Abbreviation	
Optima	al Cont	rol			10-M=VOST-102-m01	
Module	e coord	linator		Module offered by	·	
Dean o	f Studi	es Mathematik (Matl	hematics)	Institute of Mathem	natics	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
Duration     Module level       1 semester     graduate		Registration for the ning of the course of the specified registr to qualify for admiss certain percentage of the respective detail exercise will be con sessment. If studen assessment over th gistration for assess will be admitted to a ster. For assessment lification for admiss	Other prerequisites Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-			
Basics in optimal control of ordinary and partial differential equations, theory of optimal control, conditions for						
optimality, methods for numerical solution.						

Recommended previous knowledge:

We recommend basic knowledge of functional analysis and ordinary differential equations, such as can be acquired in the modules "Introduction to Functional Analysis" and "Ordinary Differential Equations". Knowledge of the contents of the module "Basics in Optimization" may also be useful.

Intended learning outcomes

The student is acquainted with advanced methods in optimal control. He gains the ability to work on contemporary research questions in continuous optimization.

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

V + Ü (no information on SWS (weekly contact hours) and course language available)

**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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)

Language of assessment: German, English

Allocation of places

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**Additional information** 

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Workload

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Teaching cycle

Master's with	major Computational Mathematics
(2012)	

## Module appears in

Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module title					Abbreviation		
Astrophysics				_	11-A4-072-m01		
Module	e coord	inator		Module offered by			
Manag and As	ing Dire	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade					
Duratio	on	Module level	Other prerequisites	i			
Duration   Module level   Other prerequisites     1 semester   undergraduate   Admission prerequisite to assessment: successful completion 50% of exercises. Certain prerequisites must be met to qualify sion to assessment. The lecturer will inform students about the ve details at the beginning of the course. Registration for the core be considered a declaration of will to seek admission to assess students have obtained the qualification for admission to assess over the course of the semester, the lecturer will put their regis assessment into effect. Students who meet all prerequisites wi mitted to assessment at a later date, students will have to obtain the qualifor admission to assessment at a later date, students will have to obtain the qualifor admission to assessment anew.     Contents					on of approx. fy for admis- the respecti- ecourse will essment. If sessment gistration for will be ad- mester. For qualification		
Instory pes an stellar large-s nucleo Intende The stu physica ons. Th	d detec mediur scale str synthes <b>ed lear</b> udents al obse ney kno	nomy, coordinates an stors, stellar structure, n, structure of the Milk ructure of the universe, sis, cosmic microwave <b>ning outcomes</b> are familiar with the mi rvations and evaluatio w the structure of the u	stellar atmospheres, st y Way, local universe, e , Friedmann World Mod background radiation, odern world view of Ast ns. They are able to use universe, e.g. of stars a	ellar evolution, final expanding space-tim els, thermodynamics structure formation, crophysics. They know e these methods to p nd galaxies and under	e scales in outer spa stages of stellar evo e, galaxies, active ga s of the early univers inflation w methods and tools ilan and analyse own erstand the process	s for astro- n observati- of their deve-	
lopmer	nt.						
Course	es (type	, number of weekly cor	ntact hours, language –	- if other than Germa	in)		
V + S (I	no infor	mation on SWS (week	ly contact hours) and co	ourse language avail	able)		
Metho ster, in	<b>d of ass</b> Iformati	sessment (type, scope, ion on whether module	, language — if other th e can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
written	exami	nation (approx. 120 mi	nutes)				
Allocat	tion of <sub>l</sub>	olaces					
Only as	s part o	f pool of general key sl	kills (ASQ): 15 places. P	laces will be allocate	ed by lot.		
Additio	onal inf	ormation					
Workload							
Poferred to in LDO L (examination regulations for teaching degree programmer)							
	<b>NEIGHER TO III LE O I</b> (Examination regulations for leaching-degree programmes)						
modul	Module appears in						
Master's w (2012)	vith 1 majo	r Computational Mathematics	JMU Würzburg ● g cord Master (120	enerated 26-Aug-2024 • exan ECTS) Computational Mather	n. reg. data re- natics - 2012	page 123 / 172	

Bachelor' degree (1 major) Physics (2007)
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2009)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Physics (2008)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Bachelor' degree (1 major) Aerospace Computer Science (2011)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2008)
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module title Abbreviation					Abbreviation		
Cosmo	Cosmology 11-AKM-092-m01						
Module	e coord	inator		Module offered by			
Managi and Ast	ing Dire trophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as-					
			admission to assess	sment anew.	ave to obtain the qualification for		
Conten	 ts		<u> </u>				
Expand matter, and gal	ling spa primor laxy clu	ace-time, Friedmannian c dial nucleosynthesis, co sters, intergalactic medi	osmology, basics of smic microwave bacl um, cosmological pa	general relativity, the «ground, structure fo rameters	e early universe, inflation, dark rmation, supercluster, galaxies		
Intende	ed learr	ning outcomes					
The stu le to rel scientif	dents l late the ic ques	nave basic knowledge of em to observations. They stions.	cosmology. They knc have gained insights	w the theoretical me into current researc	ethods of cosmology and are ab- h topics and are able to work on		
Course	<b>s</b> (type,	, number of weekly conta	ct hours, language –	- if other than Germa	n)		
R + V (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)		
Methoo ster, in	<b>l of ass</b> formati	e <b>ssment</b> (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and							
examin Langua	ation re	egulations) 2009. ssessment: German. Eng	lish				
Allocat	ion of p	olaces					
Additio	nal info	ormation					
Worklo	ad						
Teachi	ng cycl	9					

## Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Module title A					Abbreviation		
Plasma	a-Astro	physics			11-APL-092-m01		
Module coordinator				Module offered by			
Manag and As	ing Dire	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	nd Astronomy		
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade		• • • •			
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate	Certain prerequisite	s must be met to qu	alify for admission to	o as-	
			sessment. The lectu	rer will inform stude	nts about the respec	ctive details	
			at the beginning of	the course. Registrat	ion for the course wi	ill be con-	
			sidered a declaratio	n of will to seek adm	nission to assessme	nt. If stu-	
			dents have obtained	d the qualification fo	r admission to asse	ssment over	
			the course of the se	mester, the lecturer	will put their registra	ation for as-	
			sessment into effec	t. Students who mee	t all prerequisites w	ill be admit-	
			ted to assessment i	n the current or in th	e subsequent seme	ster. For as-	
			sessment at a later	date, students will h	ave to obtain the qu	alification for	
			admission to asses	sment anew.			
Conter	nts						
Plasma getic p accele galaxie	a Astrop articles ration v es and o	ohysics: Dynamics of ch . Properties of magneti ia shock waves and via other cosmic objects.	narged particles in elec c turbulence. Propagat a interaction with plasm	tric and magnetic fie ion of solar particles 1a turbulence. Partic	lds. Transport equat within the solar wir le acceleration and t	ions for ener- id. Particle transport in	
Intend	ed lear	ning outcomes					
The stu	idents	have basic knowledge	of Plasma Astrophysics	. They have mastere	d the theoretical des	scription of	
motior compa	n and ao re and	cceleration of charged   evaluate theory and ex	particles in space, they periments.	know corresponding	g measuring method	s and can	
Course	<b>s</b> (type	, number of weekly cor	itact hours, language –	- if other than Germa	n)		
R + V (I	no infoi	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
Metho ster, in	<b>d of ass</b> format	sessment (type, scope, ion on whether module	language — if other the can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.						amination in nutes) or c) esentation sessment demic and	
Allocat	tion of	places					
Additional information							
Workload							
Teachi	Teaching cycle						
reacin	<u>5</u> cycl	~					
L							
Master's w	ith 1 maio	r Computational Mathematics	IMU Würzhurg ● ợ	enerated 26-Aug-2024 • exam	1. reg. data re-	page 127 / 172	
(2012)			cord Master (120	ECTS) Computational Mather	natics - 2012	page 12/ / 1/2	

### Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Modul	e title				Abbreviation		
Introdu	uction t	o Space Physics			11-ASP-092-m01		
Module coordinator				Module offered by			
Managing Director of the Institute of Theoretical Physics and Astrophysics			Theoretical Physics	Faculty of Physics a	and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade		• • • •			
Duratio	on	Module level	Other prerequisites	i			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of sidered a declaratio dents have obtained	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over				
the course of the semester, the lecturer will sessment into effect. Students who meet al ted to assessment in the current or in the su sessment at a later date, students will have admission to assessment anew			will put their registra et all prerequisites w e subsequent semes ave to obtain the qu	ation for as- ill be admit- ster. For as- alification for			
Conter	nts						
1. Over 2. Dyna 3. Elem 4. The 5. Acce 6. Instr Intend	view amics o nents of sun and eleration ruments <b>ed lear</b>	f charged particles in r f space physics d heliosphere n and transport of ener s to measure energetic <b>ning outcomes</b>	nagnetic and electric fi getic particles in the he particles in extraterres	elds eliosphere trial space			
The stu charge measu	udents   d partic ring me	have basic knowledge cles in space and in the thods.	of Space Physics, in pa e heliosphere. They knc	rticular of the charac w relevant paramete	cterisation of the dyr ers, theoretical conce	namics of epts and	
Course	es (type	, number of weekly cor	ntact hours, language –	- if other than Germa	ın)		
R + V (1	no infor	mation on SWS (week	v contact hours) and co	ourse language avail	able)		
Metho	<b>d of ass</b> formati	sessment (type, scope	language — if other th	an German, examina a bonus)	ition offered — if not	every seme-	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German. English							
Allocation of places							
 Additional information							
Workload							
Master's w (2012)	vith 1 majo	r Computational Mathematics	JMU Würzburg • go cord Master (120	enerated 26-Aug-2024 • exan ECTS) Computational Mather	n. reg. data re- matics - 2012	page 129 / 172	

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

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# Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Module title					Abbreviation		
Atmos	sphere	and Space Physics		11-AWP-092-m01			
Modu	le coor	dinator		Module offered by			
Mana and A	ging Dii strophy	rector of the Institute of	Theoretical Physics	Faculty of Physics and Astronomy			
ECTS	Meth	od of grading	Only after succ. con	ly after succ. compl. of module(s)			
6	nume	erical grade					
Duration Module level Other prerequis		Other prerequisites					
1 semester		graduate	Certain prerequisites Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification fo				
Canto							
Struct tary m exopla Intend The st and n ry spa Cours R + V Methor ster, i a) writ group or d) p Assess and w exami Langu	Contents     Structure of planetary atmospheres. Interaction of planetary atmospheres with the Sun. Physics of clouds. Plane tary magnetospheres and interplanetary medium. (Micro) meteorites, asteroids, planetary rings. Atmospheres of exoplanets.     Intended learning outcomes     The students have knowledge of the physics of planetary atmospheres, especially of the atmosphere of the Earth and near-Earth space. They are able to apply the acquired knowledge to the solution of problems of interplanetary space missions.     Courses (type, number of weekly contact hours, language — if other than German)     R + V (no information on SWS (weekly contact hours) and course language available)     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)     a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)     Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2000						
Alloca	ation of	places					
		P.4000					
Vqqiti	ional in	formation					
Auuit	ionat III						
WORK	Workload						
Teach							
Refer	red to in	LPOI (examination reg	gulations for teaching-	degree programmes)			
Master's (2012)	with 1 maj	or Computational Mathematics	JMU Würzburg ● g cord Master (120	enerated 26-Aug-2024 • exan ECTS) Computational Mather	n. reg. data re- natics - 2012	page 131 / 172	

# Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation			
Introduction to Plasmaphysics 11-EPP-092-m01						
Module coordinator		Module offered by				
Managing Director of the Institute and Astrophysics	of Theoretical Physics	Faculty of Physics and Astronomy				
ECTS Method of grading	S Method of grading Only after succ. compl. of module(s)					
6 numerical grade						
Duration Module level	Other prerequisites	Other prerequisites				
1 semester graduate	Certain prerequisite sessment. The lectu at the beginning of sidered a declaratio dents have obtaine the course of the se	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the comester, the lecturer will put their registration for a for a				
	sessment into effect ted to assessment i sessment at a later admission to asses	t. Students who mee in the current or in th date, students will h sment anew.	t all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for			
Contents						
Plasma Astrophysics: Dynamics o Transport equations for energetic thin the solar wind, Particle accele celeration and transport in galaxie Intended learning outcomes	f charged particles in elec particles, Properties of m eration via shock waves a es and other astrophysica	tric and magnetic fie agnetic turbulence, F nd via interaction wit l objects, Cosmic rad	lds, Magnetohydrodynamics, Propagation of solar particles wi- h plasma turbulence, Particle ac- liation.			
The students know the principles	of Plasma Physics, espec	ially the description (	of transport phenomena in plas-			
ma. They are able to solve basic p	problems of Plasma Physic	cs and to apply this k	nowledge to Astrophysics.			
Courses (type, number of weekly	contact hours, language –	– if other than Germa	n)			
V + R (no information on SWS (we	ekly contact hours) and co	ourse language avail	able)			
<b>Method of assessment</b> (type, sco ster, information on whether mod	pe, language — if other th ule can be chosen to earn	an German, examina 1 a bonus)	tion offered — if not every seme-			
a) written examination (approx. 9) groups (approx. 30 minutes per ca project report (approx. 8 to 10 pag (approx. 30 minutes)	o minutes) or b) oral exam andidate, for modules wit ges, time to complete: 1 to	nination of one candi h less than 4 ECTS cr o 4 weeks) or d) prese	date each or oral examination in edits approx. 20 minutes) or c) entation/seminar presentation			
Assessment offered: When and ho and will be announced in due forr examination regulations) 2009. Language of assessment: German	Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					
Allocation of places						
Additional information	Additional information					
Workload	Workload					
Teaching cycle						

## Module appears in

Modul	Module title Abbreviation						
Solid S	Solid State Physics 2 11-FK2-092-m01						
Modul	e coord	inator		Module offered by			
Managing Director of the Institute of Ap			oplied Physics Faculty of Physics and Astronomy				
ECTS	Metho	od of grading	Only after succ. compl. of module(s)				
8	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ester	graduate	Certain prerequisite	s must be met to qu	alify for admission to	o as-	
			sessment. The lectu	rer will inform stude	nts about the respec	tive details:	
			at the beginning of t	the course. Registrat	ion for the course wi	ill be con-	
			sidered a declaratio	n of will to seek adm	nission to assessme	nt. If stu-	
			dents have obtained	d the qualification fo	r admission to asses	ssment over	
			the course of the se	mester, the lecturer	will put their registra	ition for as-	
			sessment into effect	t. Students who mee	t all prerequisites wi	ill be admit-	
			ted to assessment in	n the current or in th	e subsequent semes	ster. For as-	
			sessment at a later	date, students will h	ave to obtain the qu	alification for	
			admission to assess	sment anew.			
Conter	its						
Advan	ced Sol	id-State Physics. Electror	ns in periodic potentia	al - the band structur	re. Dynamics in the s	semi-classi-	
cal mo	del. Die ns and d	electric properties and fei	rroelectrics. Semicon	ductors. Magnetism.	Superconductivity.	Coupled ex-	
Intend		ning outcomes					
The ctu	idonta l	have specific and advand	ad knowladge in the	field of Solid State [	Dhucica Thou are the	oratically ab	
le to sp	pecialis	e in a sub-discipline of S	olid-State Physics.		mysics. mey are me		
Course	<b>s</b> (type	, number of weekly conta	act hours, language –	- if other than Germa	ın)		
R + V (I	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)		
Metho ster, in	<b>d of ass</b> formati	sessment (type, scope, la ion on whether module c	anguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
a) writt	en exa	mination (approx. 90 mir	nutes) or b) oral exam	ination of one candi	date each or oral exa	amination in	
groups	(appro	ox. 30 minutes per candic	late, for modules with	n less than 4 ECTS cr	edits approx. 20 mir	nutes) or c)	
project	t report	(approx. 8 to 10 pages, t	ime to complete: 1 to	4 weeks) or d) prese	entation/seminar pre	esentation	
(appro	x. 30 m	inutes) ffored, When and how of	ton accordment will b	a offered demender	on the method of eac	accoment	
Assess and wi	ill he an	nounced in due form und	ten assessment will i der observance of Sec	tion 22 Subsection	on the method of ass o ASPO (general aca	demic and	
examir	nation r	egulations) 2009.			Shore (general aca		
Langua	age of a	ssessment: German, Eng	glish				
Allocat	tion of p	olaces					
Additio	onal inf	ormation					
Workload							
Teaching cycle							
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)							
Module appears in							
Master's u	ith 1 maio	r Computational Mathematics	IMII Würzburg • go	enerated 26-Aug-2024 • exam	n regi data re-	nage 125 / 172	
(2012)	ini i maju	r computational mathematics	cord Master (120	ECTS) Computational Mather	natics - 2012	puge 135 / 1/2	

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

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Workload						
Teaching cycle						
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
e 137 / 172						
Generation of the second secon						

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module	e title				Abbreviation		
Group <sup>-</sup>	Group Theory 11-GRT-092-m01						
Module coordinator				Module offered by	<u> </u>		
Managing Director of the Institute of Th and Astrophysics			neoretical Physics	Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade		• • • •			
Duratio	n	Module level	Other prerequisites				
Duration Module level   1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for					
Conton	te			Sment anew.			
Group t	theony	Finito groups Lio groups	Lio algobra Dopicti	on Toncore Classifi	cation theorem Ann	lications	
Intende	d loar	rinite groups. Lie groups	. Lie algebia. Depicti		Lation theorem. App	lications.	
The stu group t lation a	idents l heory a and pro	know the basics of group and to solve them by usir cessing of physical prob	theory, especially of ng the acquired meth- lems.	Lie groups. They are ods. They are	able to identify prol apply group theory	olems of to the formu-	
Course	<b>s</b> (type	, number of weekly conta	ict hours, language –	- if other than Germa	n)		
R + V (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)		
Method ster, in	<b>d of ass</b> formati	s <b>essment</b> (type, scope, la on on whether module ca	inguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
a) writt groups project (approx Assess and wil examin Langua	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.						
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Workload							
Teaching cycle							
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)							
 Module appears in							
Master's wi	ith 1 major	Computational Mathematics	JMU Würzburg ● ge cord Master (120	enerated 26-Aug-2024 • exan ECTS) Computational Mather	n. reg. data re- natics - 2012	page 139 / 172	

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Modul	e title		Abbreviation				
Semic	onducto	or Lasers - Principles an	d Current Research		11-HLF-092-m01		
Modul	e coord	inator		Module offered by			
Managing Director of the Institute of Ap			oplied Physics Faculty of Physics and Astronomy				
ECTS Method of grading			Only after succ. compl. of module(s)				
6	nume	rical grade					
Durati	on	Module level	Other prerequisites	Other prerequisites			
1 seme	ester	graduate	Certain prerequisite	s must be met to qu	alify for admission to as-		
			sessment. The lecturer will inform students abou		nts about the respective details		
	at the beginning of the course. Registration for the c		ion for the course will be con-				
			sidered a declaratio	n of will to seek adm	nission to assessment. If stu-		
			dents have obtained	d the qualification fo	r admission to assessment over		
			the course of the se	mester, the lecturer	will put their registration for as-		
			sessment into effec	t. Students who mee	t all prerequisites will be admit-		
			ted to assessment i	n the current or in th	e subsequent semester. For as-		
			sessment at a later	date, students will h	ave to obtain the qualification for		
			admission to assess	sment anew.			
Conte	nts						
This le	cture d	iscusses the principles	of laser physics, based	l on the example of s	semiconductor lasers, and cur-		
rent de	evelopn	nents regarding compon	ents. The principles of	f lasers are describe	d on the basis of a general laser		
model	, which	will then be extended to	o special aspects of se	miconductor lasers.	Basic concepts such as thres-		
riers a	nd phot	tons. Other tonics of the	lecture are ontical pro	cesses in semicond	uctors, layer and ridge wayegui-		
des, la	iser res	onators, mode selection	, dynamic properties a	as well as technology	for the generation of semicon-		
ductor	lasers.	The lecture closes with	current topics of laser	research such as qu	antum dot lasers, quantum cas-		
cade la	asers, t	erahertz lasers or high-p	erformance lasers.				
Intend	ed lear	ning outcomes					
The sto knowle	udents edge to	have advanced knowlec modern questions and	ge of the principles of know the applications	semiconductor-lase in the current devel	r physics. They can apply their opment of components.		
Course	<b>es</b> (type	, number of weekly cont	act hours, language –	- if other than Germa	n)		
R + V (	no infoi	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)		
Metho	d of as	sessment (type, scope,	anguage — if other the	an German, examina a bonus)	tion offered — if not every seme-		
a) writ	ten eva	mination (approxoo.m	inutes) or b) oral exam	ination of one candi	date each or oral examination in		
groups	s (appro	ox. 30 minutes per cand	date. for modules with	less than 4 ECTS cr	edits approx. 20 minutes) or c)		
projec	t report	(approx. 8 to 10 pages,	time to complete: 1 to	4 weeks) or d) prese	entation/seminar presentation		
(appro	x. 30 m	inutes)					
Assessment offered: When and how often assessment will be offered depends on the method of assess				on the method of assessment			
and wi	Ill be an	inounced in due form ur	der observance of Section 32 Subsection 3 ASPO (general academic and				
Langu	nation r age of a	egulations) 2009. Issessment: German Fr	adich				
Allocation of places							
Additi	Additional information						
	_						
Workle	oad						

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

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Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2011)

Module	e title				Abbreviation			
Semico	Semiconductor Physics 11-HLP-092-m01							
Module	e coord	inator		Module offered by				
Managing Director of the Institute of Applied			Applied Physics	Faculty of Physics and Astronomy				
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)				
6	nume	rical grade						
Duratio	on	Module level	Other prerequisites	ites				
1 seme	ster	graduate	Certain prerequisite	s must be met to qua	alify for admission to	o as-		
			sessment. The lecturer will inform students about the respective of			ctive details		
			at the beginning of t	the course. Registrat	ion for the course w	ill be con-		
			sidered a declaratio	n of will to seek adm	ission to assessme	nt. If stu-		
			dents have obtained	a the qualification to	r admission to asse	ssment over		
			coccmont into offor	t Students who moo	t all proroquisitos w	ill bo admit		
			ted to assessment i	n the current or in th	e subsequent seme	ster For as-		
			sessment at a later	date, students will h	ave to obtain the qu	alification for		
			admission to assess	sment anew.	ave to obtain the qu			
Conten	ts							
Advanc	ad ova	mination of crystal bor	ding and the electronic	c hand structure of s	omiconductors Ont	ical ovcitati		
ons an	d their	coupling effects. Electr	on-phonon coupling. T	emperature-depende	ent transport proper	ties. Quanti-		
sation	effects	of semiconductors wit	h reduced dimensions.	(Semi-)magnetic ser	niconductors.			
Intende	ed lear	ning outcomes						
The stu	Idents l	have specific and adva	nced knowledge in the	field of Semiconduc	tor Physics. They kn	ow the physi-		
materiz	als.	or semiconductors and	i nave gamed an overvi	ew of the important	characteristics of se	miconductor		
Course	<b>s</b> (type	, number of weekly con	itact hours, language –	- if other than Germa	n)			
R + V (r	no infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)			
Metho	d of ass	sessment (type, scope,	language — if other the	an German, examina	tion offered — if not	every seme-		
ster, in	formati	on on whether module	can be chosen to earn	a bonus)				
a) writt	en exai	mination (approx. 90 m	ninutes) or b) oral exam	ination of one candi	date each or oral ex	amination in		
groups	(appro	x. 30 minutes per canc	lidate, for modules with	1 less than 4 ECTS cr	edits approx. 20 mil	iutes) or c)		
(approx	x. 30 m	(approx. 8 to 10 pages inutes)		4 weeks) of u) prese	entation/seminar pro	esentation		
Assess	ment o	ffered: When and how	often assessment will l	pe offered depends o	on the method of as	sessment		
and wil	ll be an	nounced in due form u	nder observance of Sec	ction 32 Subsection	3 ASPO (general aca	demic and		
examin	ation r	egulations) 2009. ssossmont: Gorman, F	nglich					
Allocat	ion of r							
Allocal		Jaces						
Additio	nal inf	ormation						
Workload								
Teaching cycle								
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)								
				0				
Master's wi	ith 1 maio	Computational Mathematics	IMII Würzburg ● ge	enerated 26-Aug-2024 • evan	n regi data re-	nage 1/2 / 172		
(2012)			cord Master (120	ECTS) Computational Mather	natics - 2012	Page 14) / 1/2		

# Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2012) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)
Module	Module title			Abbreviation		
Semico	Semiconductor Nanostructures 11-HNS-092-mo1					
Module	Module coordinator			Module offered by		
Manag	ing Dire	ector of the Institute of Ar	oplied Physics	d Physics Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	,	
6	nume	rical grade		1		
Duratio	on	Module level	Other prerequisites			
1 seme	ester	graduate	Certain prerequisite	s must be met to qua	alify for admission to as-	
1 Semester			sessment. The lectu	rer will inform stude	nts about the respective details	
			at the beginning of t	ion for the course will be con-		
			sidered a declaratio	n of will to seek adm	ission to assessment. If stu-	
			dents have obtained	d the qualification fo	r admission to assessment over	
			the course of the se	mester, the lecturer	will put their registration for as-	
			sessment into effect	t. Students who mee	t all prerequisites will be admit-	
			ted to assessment i	n the current or in the	e subsequent semester. For as-	
			sessment at a later	date, students will h	ave to obtain the qualification for	
			admission to assess	sment anew.		
Conten	nts					
Semico	onducto	or nanostructures are frec	quently referred to as	"artificial materials"	. In contrast to atoms, molecules	
or mac	roscopi	c crystals, their electroni	c, optical and magne	tic properties can be	e systematically tailored by chan-	
ging th	eir size	. The lecture addresses t	echnological challen	ges in the preparatio	n of semiconductor nanostruc-	
tures o	f varyin	g dimensions (2D, 1D, OL n optical proportios and l	D). It provides the bas	Sic theoretical conce	pts to describe their properties,	
of nove	el optoe	electronic and quantum p	hotonic devices base	ed on such nanostru	ctures, including building blocks	
for qua	intum c	ommunication and quan	tum computing archi	tectures.	,	
Intend	ed lear	ning outcomes				
The stu	udents l	know the theoretical prin	ciples and characteri	stics of semiconduct	tor nanostructures. They have	
knowle	edge of	the technological metho	ds to fabricate such s	structures, and of the	eir applications to novel photonic	
devices	s. They	are able to apply their kn	iowledge to problems	if oth on them. Come	arcn.	
	s (type	, number of weekly conta	ct nours, language –	- If other than Germa	n)	
			if other the		tion offered if not even come	
ster, in	<b>d of ass</b> formati	on on whether module ca	an be chosen to earn	a bonus)	tion offered — If not every seme-	
a) writt	en exa	nination (approx. 90 min	utes) or b) oral exam	ination of one candi	date each or oral examination in	
groups	appro	x. 30 minutes per candid	late, for modules with	n less than 4 ECTS cr	edits approx. 20 minutes) or c)	
project	t report	(approx. 8 to 10 pages, ti	ime to complete: 1 to	4 weeks) or d) prese	entation/seminar presentation	
(approx	x. 30 m	inutes) ffored, When and how of	ton occorrent will k	a offered dependence	an the method of accessment	
and wi	ll he an	nounced in due form unc	len assessment will t ler observance of Sec	tion 22 Subsection :	a ASPO (general academic and	
examir	nation r	egulations) 2009.				
Langua	Language of assessment: German, English					
Allocat	Allocation of places					
Additio	onal inf	ormation				
Worklo	bad					

# Teaching cycle

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

Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)
Master's degree (1 major) Functional Materials (2012)

Module title				Abbreviation		
Compu	tationa	l Astrophysics			11-NMA-111-m01	
Module	e coord	inator		Module offered by		
Manag and As	ing Dire trophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester graduate		graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as-			
			admission to assess	sment anew.	·	
Conten	Contents					
Various rithms Lattice- ENO). M CL).	s metho (tree- a Boltzm Aethod	ods used in astrophysical nd polynomial codes). Pa ann). Hyperbolic conserv s of high-performance co	simulations with sp article-mesh methods vation laws (fluid dyn mputing. Message-p	ecial emphasis on th s (particle-in-cell met amics, finite differer assing interface (MP	eir applications. N-body algo- thods). Vlasow methods (e.g., nce method, Riemann solver, I). GPGPU programming (Open-	
Intende	ed learı	ning outcomes				
The stu sics wit proach	dents a th the h such p	are able to solve typical p nelp of numerical simulat roblems and of validatin	roblems and equatic ions. They are especi g the results.	ons of Astrophysics a ally capable of choo	nd other subdisciplines of Phy- sing adequate strategies to ap-	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
V + R (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Methoo ster, in	<b>d of ass</b> formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
a) writt in grou weeks) Assess and wil examin Langua	a) written examination (approx. 120 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German English					
Allocat	ion of p	olaces				
Additional information						
Worklo	ad					
Teachi	ng cycl	e				
L						

### Module appears in

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics (2011)

Master's degree (1 major) Computational Mathematics (2012)

<b>AA</b> - <b>J</b> - <b>J</b>	- +!+  -				ALL	
Modul	e title	hanice II		<u>.</u>	Abbreviation	
Quant					11-QM2-092-m01	
Modul	Module coordinator			Module offered by		
Manag and As	ing Dire trophys	ector of the Institute of Th sics	neoretical Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Durati	on	Module level	Other prerequisites			
1 semester undergraduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as-				
			admission to assess	sment anew.		
Conter	nts					
Physic gree. V should 1. Secc 2. Ban 3. Ang 4. Scat 5. Rela of ator 6. Qua 7. Can	"Quantum mechanics II" constitutes the central theoretical course of the international Master's program in Physics. It builds upon basics which are acquired in the lecture "Quantum mechanics I" of the Bachelor's de- gree. While the specific emphasis can be adjusted individually, the core topics that are supposed to be covered should include: 1. Second quantisation: Fermions and bosons 2. Band structures of particles in a crystal 3. Angular momentum, symmetry operators, Lie Algebras 4. Scattering theory: Potential scattering, partial wave expansion 5. Relativistic quantum mechanics: Klein-Gordon equation, Dirac equation, Loretz group, fine structure splitting of atomic spectra 6. Quantum entanglement					
Intend	ed lear	ning outcomes				
The students acquire in-depth knowledge of advanced quantum mechanics and have a thorough understanding of the mathematical and theoretical concepts of the listed topics. They are able to describe or model problems of modern theoretical Quantum Physics mathematically, to solve problems analytically, to use approximation me- thods and to interpret the results physically. The course is pivotal to subsequent theory courses in Astrophysics, High-Energy Physics and Condensed Matter/Solid-State Physics. The course is mandatory for all Master's students.						
Course	<b>s</b> (type	, number of weekly conta	act hours, language –	- if other than Germa	an)	
R + V (	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
<b>Metho</b> ster, in	<b>d of ass</b> formati	essment (type, scope, la on on whether module c	anguage — if other tha an be chosen to earn	an German, examina a bonus)	ition offered — if not every seme-	
a) writt groups project	en exa (appro t report	mination (approx. 90 mir x. 30 minutes per candic (approx. 8 to 10 pages, t	nutes) or b) oral exam late, for modules with ime to complete: 1 to	ination of one candi n less than 4 ECTS cr 4 weeks) or d) prese	date each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation	

(approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

## Allocation of places

### Additional information

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# Workload

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# Teaching cycle

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

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## Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation			
Renormalizat	Renormalization Theory 11-RNT-092-mo1					
Module coord	linator		Module offered by			
Managing Dir and Astrophy	ector of the Institute of Th sics	neoretical Physics	Faculty of Physics a	nd Astronomy		
ECTS Method of grading Only after succ. compl. of module(s)						
6 nume	rical grade					
Duration	Module level	Other prerequisites				
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as-				
		ted to assessment it sessment at a later admission to assess	n the current or in th date, students will h sment anew.	e subsequent semester. For as- ave to obtain the qualification for		
Contents	•					
behaviour for levance for ph ons. Stochast berg-Ma diffe and comparis <b>Intended lear</b> The students tions. They kr tasks.	dynamics beyond the eq nase diagrams in cryogen tic non-linear partial differential equations. Symme ton of different RG method <b>ning outcomes</b> have gained an overview tow important examples a	uilibrium. Classical-c ic temperatures. Inst rential equations. Co etries, e.g. in the stoc ds. of renormalisation gr and corresponding sc	ritical and quantum- ability of statistical a nstruction of generat hastic Burgers' equa roup methods for not olving methods and a	critical phenomena and their re- and dynamic mean-field soluti- ting functionals. Halperin-Hohen- ation (KPZ equation). Introduction		
Courses (type	, number of weekly conta	ict hours, language –	- if other than Germa	n)		
R + V (no info	rmation on SWS (weekly o	contact hours) and co	ourse language avail	able)		
Method of as ster, informat	<b>sessment</b> (type, scope, la ion on whether module ca	inguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocation of	places					
Additional inf	Additional information					
Workload						

### Teaching cycle

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

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Module appears in

Modul	e title				Abbreviation		
Relativ	vistical	Quantumfield Theory			11-RQFT-092-m01		
Modul	e coord	linator		Module offered by			
Manag and As	ging Dir strophy	ector of the Institute of sics	Theoretical Physics	Faculty of Physics and Astronomy			
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)			
8	nume	rical grade		• • • •			
Durati	on	Module level	Other prerequisites				
Duration         Module level           1 semester         graduate		Certain prerequisite sessment. The lectur at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.				
Conter	nts						
Symmetheory norma Intend The stu	etries. l . Feynm lisation <b>ed lear</b> udents	agrange formalism for ian rules. Quantum ele i. <b>ning outcomes</b> have mastered the prir	fields. Field quantisation ctrodynamic processes	on. Gauge principle a in Born approximati mathematics of relat	and interaction. Pert on. Radiative correc ivistic quantum fielc	urbation tions and re-	
They k proces standi	now ho ses in t ng of ra	w to use perturbation t the framework of quant diative corrections and	heory and how to apply um electrodynamics in I renormalisation.	/ Feynman rules. The leading order. More	y are able to calcula over, they have a ba	te basics sic under-	
Course	<b>es</b> (type	, number of weekly cor	ntact hours, language –	- if other than Germa	n)		
R + V (	no info	rmation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
<b>Metho</b> ster, ir	<b>d of as</b> format	<b>sessment</b> (type, scope, ion on whether module	language — if other the can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
a) writt groups project (appro Assess and wi examin Langua	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Alloca	tion of	places					
Additi	onal inf	ormation					
Workload							
Teachi	ng cvcl	e					
Master's w (2012)	vith 1 majo	r Computational Mathematics	JMU Würzburg • ge cord Master (120	enerated 26-Aug-2024 • exan ECTS) Computational Mather	n. reg. data re- natics - 2012	page 153 / 172	

#### Module appears in

Module title					Abbreviation	
Theory	Theory of Relativity         11-RTT-092-m01					
Module	e coord	inator		Module offered by		
Managi and Ast	ing Dire trophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading Only after succ. compl. of module(s)						
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit-				
			sessment at a later	date, students will h	ave to obtain the qualification for	
Conton	+c			sment anew.		
Mather ments o general	natical of diffe l relativ	foundations of the theor rential geometry; electro rity; stellar models; introc ning outcomes	y of relativity; differe dynamics as an exam duction to cosmology	ntial forms; brief sun pple of a relativistic g y; Hamiltonian formu	nmary of special relativity; ele- gauge theory; field equations of lation	
The stu	dents a	are familiar with the basi	c physical and mathe	ematical concepts of	general relativity. They have a	
mather able to	natical apply t	understanding of the for the acquired knowledge t	mulation of general r o problems of Astrop	elativity on the basis	gy.	
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
R + V (n	infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methoo ster, in	<b>l of ass</b> formati	s <b>essment</b> (type, scope, la on on whether module ca	nguage — if other than be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
a) writt groups project (approx Assess	en exar (appro report k. 30 m ment o	nination (approx. 90 min x. 30 minutes per candid (approx. 8 to 10 pages, ti inutes) ffered: When and how of	utes) or b) oral exam late, for modules with ime to complete: 1 to ten assessment will l	ination of one candi n less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	date each or oral examination in edits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment	
and wil examin Langua	l be an ation r ge of a	nounced in due form unc egulations) 2009. ssessment: German. Eng	ler observance of See lish	ction 32 Subsection	3 ASPO (general academic and	
Allocat	ion of r	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
			· · · · · · · · · · · · · · · · · · ·			

#### Module appears in

Module title				Abbreviation			
Statistics, Da	ta Analysis and Comput	ter Physics		11-SDC-092-m01			
Module coord	linator		Module offered by				
Managing Dir	ector of the Institute of A	Applied Physics	Faculty of Physics a	nd Astronomy			
ECTS Meth	od of grading	Only after succ. com	pl. of module(s)				
4 nume	rical grade						
Duration	Module level	Other prerequisites					
1 semester	graduate	Certain prerequisite	s must be met to qua	alify for admission to a	as-		
		sessment. The lectu	rer will inform stude	nts about the respecti	ve details		
		at the beginning of t	ne course. Registrat	ion for the course will	ue con-		
		dents have obtained	the qualification fo	radmission to assessifient	ment over		
		the course of the se	mester. the lecturer	will put their registrati	on for as-		
		sessment into effect	t. Students who mee	t all prerequisites will	be admit-		
		ted to assessment in	n the current or in th	e subsequent semest	er. For as-		
		sessment at a later	date, students will h	ave to obtain the qual	lification for		
		admission to assess	sment anew.				
Contents							
Statistics, dat	a analysis and compute	er physics.					
Intended lear	ning outcomes						
The students Physics.	have specific and advar	nced knowledge in the	field of statistics, da	ita analysis and Comp	outational		
Courses (type	, number of weekly con	tact hours, language —	- if other than Germa	n)			
R + V (no info	rmation on SWS (weekly	v contact hours) and co	ourse language availa	able)			
Method of as ster, informat	sessment (type, scope, ion on whether module	language — if other tha can be chosen to earn	an German, examina a bonus)	tion offered — if not e	very seme-		
a) written exa groups (appro project report (approx. 30 m Assessment o and will be ar examination n Language of a	mination (approx. 90 m ox. 30 minutes per cand (approx. 8 to 10 pages, inutes) offered: When and how of mounced in due form un regulations) 2009. assessment: German, Er	inutes) or b) oral exam idate, for modules with time to complete: 1 to often assessment will b nder observance of Sec nglish	ination of one candi n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o ction 32 Subsection g	date each or oral exar edits approx. 20 minu entation/seminar pres on the method of asse 3 ASPO (general acade	nination in ites) or c) entation ssment emic and		
Allocation of	places						
Additional inf	ormation						
Workload							
Teaching cycl	Teaching cycle						
Referred to in	Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appea	ars in						
Bachelor' deg	ree (1 major) Physics (2	010)					
Bachelor deg Master's with 1 maio	ree (1 major) Physics (2	U12) JMU Würzburg • ge	enerated 26-Aug-2024 • exam	n. reg. data re-	page 157 / 172		
(2012)		cord Master (120	ECTS) Computational Mather	natics - 2012			

Bachelor' degree (1 major) Nanostructure Tech	nology (2010)
Bachelor' degree (1 major) Nanostructure Tech	nology (2012)
Bachelor' degree (1 major) Mathematical Physi	cs (2009)
Bachelor' degree (1 major) Mathematical Physi	cs (2012)
Master's degree (1 major) Mathematics (2012)	
Master's degree (1 major) Mathematics (2010)	
Master's degree (1 major) Physics (2010)	
Master's degree (1 major) Physics (2011)	
Master's degree (1 major) Nanostructure Techn	10logy (2011)
Master's degree (1 major) Nanostructure Techn	10logy (2010)
Master's degree (1 major) FOKUS Physics - Nan	ostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010	o)
Master's degree (1 major) FOKUS Physics (2011	L)
Master's degree (1 major) Computational Math	ematics (2012)

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Module	e title				Abbreviation	
Semico	onducto	or Physics and Devices			11-SPD-102-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester graduate			Certain prerequisites must be met to quality for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.			
Conten	nts		-			
Princip as of e	les of S lectroni	Semiconductor Physics.	Introduction to key the	eories on semicondu	ictors. Components from the are-	
Intend	ed lear	ning outcomes				
The stu and ph perties equation on and basic u nents of and Gu ser). Th ductors ents.	The students are familiar with the properties of semiconductors, they have gained an overview of the electronic and phononic band structures of important semiconductors and the resulting electronic, optical and thermal pro- perties. They know the principles of charge transport and are able to apply Poisson, Boltzmann and continuity equations to the solution of questions. They have gained insights into the methods of semiconductor producti- on and are familiar with the methods of planar technology and current developments in this sector, they have a basic understanding of component production. They understand the structure and function of the main compo- nents of electronics (diodes, transistor, FET, thyristor, diac, triac), microwave applications (tunnel, impatt, baritt and Gunn diode) and optoelectronics (photo diode, solar cell, light-emitting diode, semiconductor injection la- ser). They know the realisation possibilities of low-dimensional charge carrier systems on the basis of semicon- ductors and their technological importance. They are familiar with current developments in the field of compon-					
Course	<b>s</b> (type	, number of weekly cont	act hours, language —	if other than Germa	in)	
V + R (r	no infor	mation on SWS (weekly	contact hours) and co	urse language avail	able)	
Metho ster, in	<b>d of ass</b> formati	sessment (type, scope, l ion on whether module	anguage — if other tha can be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written examination (approx. 90 minutes) or oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or pro- ject report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocat	tion of <sub>l</sub>	olaces				
Additio	Additional information					

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### Workload

Teaching cycle

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

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## Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012) Master's degree (1 major) Functional Materials (2012)

Modul	e title			Abbreviation			
Supers	symmet	ry I and II			11-SUS-092-m01		
Modul	e coord	inator		Module offered by			
Manag	ing Dire	ector of the Institute of	Theoretical Physics	Faculty of Physics a	nd Astronomy		
and As	trophys	sics	·····)		,,		
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade					
Duratio	on	Module level	Other prerequisites	i i i i i i i i i i i i i i i i i i i			
1 seme	ester	graduate	Certain prerequisite	s must be met to qu	alify for admission to	o as-	
			sessment. The lectu	rer will inform stude	nts about the respec	ctive details	
			at the beginning of	the course. Registrat	ion for the course wi	ill be con-	
			sidered a declaratio	on of will to seek adm	nission to assessme	nt. If stu-	
			dents have obtained	d the qualification fo	r admission to asse	ssment over	
			the course of the se	mester, the lecturer	will put their registra	ation for as-	
			sessment into effec	t. Students who mee	t all prerequisites w	ill be admit-	
			ted to assessment i	n the current or in th	e subsequent seme	ster. For as-	
			sessment at a later	date, students will h	ave to obtain the qu	alification for	
admission to assessment anew.							
Conter	its						
Supers persym Supers ticles	symmet nmetry: symmet Phenor	ry I: Grassmann variab Algebra and multiplets ry II: Minimal supersym nenology of LEP. Tevatr	le. Coleman-Mandula the S. Superfield formalism Inmetric standard mode Inn and LHC, supersym	heorem and Haag-Lo . Breaking of supersy l. Higgs sector. The s metric neutrino mass	puszanski-Sohnius ymmetry. pectrum of supersyr s models. Violation o	theorem. Su- mmetric par- of R-parity.	
Intend	od loar	ning outcomes			models. Molation (	Ji K punty.	
The stu	idonte	have knowledge of the	mathematical and phy	cical principles of su	norsummetry and su	Inorcummo	
tric mo import	dels. T ance fo	hey understand the the r phenomenology of el	ementary particles.	cognise its connection	ons to other models	as well as its	
Course	<b>s</b> (type	, number of weekly cor	itact hours, language –	- if other than Germa	n)		
V + R (1	no infoi	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
Metho ster, in	<b>d of as</b> format	<b>sessment</b> (type, scope, ion on whether module	language — if other the can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
a) writt groups project (appro Assess and wi examir Langua	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.						
Allocat	tion of	places					
Additional information							
Workload							
Teachi	Teaching cycle						
Master's w (2012)	vith 1 majo	r Computational Mathematics	JMU Würzburg ● ge cord Master (120	enerated 26-Aug-2024 • exan ECTS) Computational Mather	n. reg. data re- natics - 2012	page 161 / 172	

#### Module appears in

Module title Abbreviation					Abbreviation		
Theoretical Elementary Particle Physics				11-TEP-092-m01			
Module	e coord	inator		Module offered by	<u> </u>		
Managing Director of the Institute of Theo and Astrophysics			Theoretical Physics	Faculty of Physics and Astronomy			
ECTS Method of grading 0		Only after succ. con	npl. of module(s)				
8	8 numerical grade						
Duratio	on	Module level	Other prerequisites	Other prerequisites			
1 semester		graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.				
Conten	its						
Fundar Gauge tensior	nental theorie 1s of th	forces and particles. Gr s. Spontaneous symme e standard model.	oups and symmetries. etry breaking. Electrow	Quark model. Princi eak standard model.	ples of quantum field theor Quantum chrome dynamic	ry. cs. Ex-	
Intend	ed lear	ning outcomes					
The students are familiar with the mathematical methods of Elementary Particle Physics. They understand the structure of the standard model based on symmetry principles and experimental observations. They know calculation methods for the processing of simple problems and processes of Elementary Particle Physics. Furthermore, they know the tests and limits of the standard model and the basics of extended theories.							
Course	<b>s</b> (type	, number of weekly con	tact hours, language –	- if other than Germa	n)		
R + V (r	no infor	mation on SWS (weekly	/ contact hours) and co	ourse language avail	able)		
Metho ster, in	<b>d of ass</b> formati	essment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not every s	seme-	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English							
Allocation of places							
Additional information							
Workload							
Teaching cycle							
Master's w (2012)	ith 1 majo	Computational Mathematics	JMU Würzburg ● go cord Master (120	enerated 26-Aug-2024 • exan ECTS) Computational Mather	n. reg. data re- page 16 natics - 2012	63 / 172	

#### Module appears in

Module title Abbreviation			Abbreviation				
Theoretical Solid State Physics     11-TFK-092-m01							
Module	e coord	inator		Module offered by	ffered by		
Managing Director of the Institute of Theoreti and Astrophysics			eoretical Physics	Faculty of Physics and Astronomy			
ECTS Method of grading Only after succ. com			Only after succ. con	npl. of module(s)			
8	8 numerical grade						
Duratio	n	Module level	Other prerequisites				
1 semester		graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for				
			admission to assess	sment anew.			
Conten	ts						
Princip thods.	les of T Magne	heoretical Solid-State Ph tism. Superconductivity.	ysics. Fermi liquid th	eory. Electron-electro	on interaction. Variational me-		
Intende	ed lear	ning outcomes					
The students have basic knowledge of the theoretical description of solid-state phenomena. They know the cor- responding mathematical or theoretical methods and are able to apply them to basic problems of solid-state theory and to understand the connections to experimental results. The individual students have elaborated on an advanced topic of solid-state theory and have discussed this topic in a seminar presentation.							
Course	<b>s</b> (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)		
R + V (r	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)		
<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)							
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.							
Allocation of places							
Additional information							
Workload							
workto	au						

#### Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Modul	Module title Abbreviation						
Experi	Experimental Particle Physics11-TPE-092-m01						
Module coordinator				Module offered by			
Managing Director of the Institute of Appli		oplied Physics	Faculty of Physics and Astronomy				
ECTS Method of grading			Only after succ. compl. of module(s)				
4	nume	rical grade					
Duratio	on	Module level	Other prerequisites	her prerequisites			
1 semester		graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective deta at the beginning of the course. Registration for the course will be con sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment of the course of the semester, the lecturer will put their registration for a sessment into effect. Students who meet all prerequisites will be adr				
			ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.				
Conter	nts						
Physic supers as well of syst	s with n symmet l as oth ematic	nodern particle detectors ry and other physics beyo er parameters of the stan errors.	at the LHC and at the ond the standard moo dard model. Introduc	e Tevatron. Discovery del. Determination of tion to modern meth	y of the Higgs boson. Search for f the top quark mass and W mass nods of analysis and assessment		
Intend	ed lear	ning outcomes					
The stu questic lysis a	The students are familiar with the principles of modern particle detector physics, especially with currently open questions of Particle Physics, which are examined by using these detectors. They know modern methods of analysis and are able to put results into context and to assess their systematic uncertainties.						
Course	<b>es</b> (type	, number of weekly conta	ict hours, language —	· if other than Germa	n)		
R + V (I	no infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)		
<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)							
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.							
Allocation of places							
Additional information							
Worklo	Workload						
Teachi	ng cycl	e					

#### Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Modul	Module title Abbreviation							
Particle Physics (Standard Model)     11-TPS-092-m01								
Modul	e coord	inator		Module offered by				
Managing Directors of the Institute of Applied Physics and Faculty of Physics and Astronomy the Institute of Theoretical Physics and Astrophysics								
ECTS Method of grading Only after succ. con				npl. of module(s)				
8	nume	numerical grade						
Durati	Duration Module level Other prerequisites							
1 seme	ester	graduate	Certain prerequisites must be met to qualify for admission to as-					
			sessment. The lectu	sessment. The lecturer will inform students about the respective of				
			at the beginning of the course. Registration for the course will be cor					
			sidered a declaratio	nission to assessme	nt. If stu-			
			dents have obtained	r admission to asse	ssment over			
			the course of the se	mester, the lecturer	will put their registra	ation for as-		
			sessment into effect	t. Students who mee	t all prerequisites w	ill be admit-		
			ted to assessment i	n the current or in th	e subsequent seme	ster. For as-		
			sessment at a later	date, students will h	ave to obtain the qu	alification for		
			admission to assess	sment anew.				
Conte	nts							
Introdu standa	uction t ard mod	o the theory of electrow lel and determination c	veak interaction and sp f model parameters.	ontaneous symmetr	y breaking. Experime	ents on the		
Intend	ed lear	ning outcomes						
The st	idents	know the theoretical fu	ndamental laws of the	standard model of P	article Physics and t	he kev ex-		
perime theore	ents tha tical res	t have established and sults in the framework (	l confirmed the standar of the standard model a	rd model. They are al and know its validity	ble to interpret expe and limits.	rimental or		
Course	<b>Courses</b> (type, number of weekly contact hours, language — if other than German)							
R + V (	no infoi	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)			
<b>Metho</b> ster, ir	<b>d of as</b> format	s <b>essment</b> (type, scope, ion on whether module	language — if other the can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment								
and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.								
Allocation of places								
Additional information								
Workload								
Teaching cycle								
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)								
Master's v	/ith 1 maio	r Computational Mathematics	IMII Würzhurσ● σ4	enerated 26-Aug-2024 • eyan	n. reg. data re-	page 160 / 172		
(2012)		. computational mathematics	cord Master (120	ECTS) Computational Mather	natics - 2012	Page 103/ 1/2		

## Module appears in

Module title Abbreviation									
Theory	Theory of Superconduction     11-TSL-092-m01								
Module coordinator Module offered by									
Manag and As	Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics								
ECTS	CTS Method of grading Only after succ. compl. of module(s)								
5	nume	rical grade							
Duration Module level Other prerequisites									
1 seme	ester	graduate	Certain prerequisite	Certain prerequisites must be met to qualify for admission to as-					
			sessment. The lectu	sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con-					
			at the beginning of						
			sidered a declaratio	sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as-					
			dents have obtained						
			the course of the se						
			sessment into effec	t. Students who mee	t all prerequisites w	ill be admit-			
			ted to assessment i	n the current or in th	e subsequent seme	ster. For as-			
			sessment at a later	date, students will h	ave to obtain the qu	alification for			
			admission to asses	sment anew.					
Conter	nts								
Introdu Phenor vity (Ar elemer	Introduction to the phenomenom of superconductivity. Microscopic theory of superconductivity (BCS theory). Phenomenological theory of superconductivity (Ginzburg-Landau theory). Mesoscopic aspects of superconducti- vity (Andreev scattering, Bobolioubov-de Gennes equation, SQUIDS). Quantum computing with superconductive elements								
Intend	ed lear	ning outcomes							
The stu the pro blems.	The students have basic knowledge of the theoretical models for the description of superconductivity. They know the properties and application areas of these models and are able to apply calculation methods to simple pro-								
Course	<b>es</b> (type	, number of weekly cor	ntact hours, language –	- if other than Germa	n)				
R + V (I	no info	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)				
<b>Metho</b> ster, in	<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)					every seme-			
<ul> <li>a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)</li> <li>Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.</li> <li>Language of assessment: German, English</li> </ul>									
Allocation of places									
Additional information									
Workload									
Teaching cycle									
Master's w (2012)	vith 1 majo	r Computational Mathematics	JMU Würzburg ● ge cord Master (120	enerated 26-Aug-2024 • exan ECTS) Computational Mather	n. reg. data re- natics - 2012	page 171 / 172			

#### Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)