

Subdivided Module Catalogue for the Subject

Nanostructure Technology

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

Examination regulations version: 2015 Responsible: Faculty of Physics and Astronomy

JMU Würzburg • generated 18-Apr-2025 • exam. reg. data record 82|224|-|-|H|2015

Learning Outcomes

German contents and learning outcome available but not translated yet.

Nach erfolgreichem Abschluss des Studiums verfügen die Absolventinnen und Absolventen über die folgenden Kompetenzen:

- Die Absolventinnen und Absolventen besitzen Abstraktionsvermögen, analytisches Denken, Problemlösungskompetenz und die Fähigkeit, komplexe Zusammenhänge zu strukturieren.
- Sie verstehen die Grundlagen und Zusammenhänge der Nanowissenschaften.
- Sie verfügen über Kenntnisse der physikalischen, chemischen und technischen Grundlagen der Nanostrukturtechnik in Theorie und Praxis sowie über die theoretischen und experimentellen Methoden zur Erlangung neuer Erkenntnisse.
- Sie verfügen über ein breites Grundlagenwissen aus den wichtigsten Teilgebieten der Nanowissenschaften sowie tiefergehende Kenntnisse in mindestens einem Teilgebiet.
- Sie sind in der Lage, sich mit Hilfe von Fachliteratur in neue Aufgabegebiete einzuarbeiten, physikalische und technische Methoden unter Anleitung auf konkrete Aufgabenstellungen anzuwenden, Lösungswege zu entwickeln und die Ergebnisse zu interpretieren und zu bewerten.
- Sie sind in der Lage, Probleme der Nanostrukturtechnik nach wissenschaftlichen Arbeitsweisen und unter Beachtung der Regeln guter wissenschaftlicher Praxis zu bearbeiten.
- Sie sind in der Lage, ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darzustellen und zu vertreten.

Wissenschaftliche Befähigung

- Die Absolventinnen und Absolventen verstehen die mathematischen, theoretischen und experimentellen Grundlagen der Nanostrukturwissenschaften und können diese anwenden.
- Die Absolventinnen und Absolventen können unter Anleitung Experimente durchführen, analysieren und die erhaltenen Ergebnisse darstellen und bewerten.
- Die Absolventinnen und Absolventen setzen die erlernten die theoretischen und experimentellen Methoden unter Anleitung zur Erlangung neuer Erkenntnisse in den Nanostrukturwissenschaften um.
- Die Absolventinnen und Absolventen sind in der Lage, Probleme mit wissenschaftlicher Arbeitsweise und unter Beachtung der Regeln guter wissenschaftlicher Praxis (Dokumentation, Fehleranalyse) zu bearbeiten.
- Die Absolventinnen und Absolventen können ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darstellen und vertreten.
- Die Absolventinnen und Absolventen können ein breites Grundlagenwissen aus den wichtigsten Teilgebieten der Nanostrukturwissenschaften sowie tiefergehende Kenntnisse in mindestens einem Teilgebiet abrufen.
- Die Absolventinnen und Absolventen verstehen die wesentlichen Zusammenhänge und Konzepte der einzelnen Teilgebiete der Nanostrukturwissenschaften.
- Die Absolventinnen und Absolventen sind in der Lage, sich mit Hilfe von Fachliteratur in neue Aufgabengebiete einzuarbeiten, sowie physikalische und technische Methoden weitgehend selbstständig auf konkrete Aufgabenstellungen anzuwenden, Lösungswege zu entwickeln und die Ergebnisse zu interpretieren und zu bewerten.
- Die Absolventinnen und Absolventen besitzen Abstraktionsvermögen, analytisches Denken, Problemlösungskompetenz und die Fähigkeit, komplexe Zusammenhänge zu strukturieren.

Befähigung zur Aufnahme einer Erwerbstätigkeit

• Die Absolventinnen und Absolventen können ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darstellen und vertreten.

Bachelor's with 1 major Nanostructure Technology	JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-	page 2 / 150
(2015)	ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015	1

- Die Absolventinnen und Absolventen sind in der Lage, konstruktiv und zielorientiert in einem heterogenen Team zusammenzuarbeiten, unterschiedliche und abweichen-de Ansichten produktiv zur Zielerreichung zu nutzen und auftretende Konflikte zu lösen.
- Die Absolventinnen und Absolventen können ihre erworbenen Kompetenzen in unterschiedlichen interkulturellen Kontexten und in internationale zusammengesetzten Teams anwenden.
- Die Absolventinnen und Absolventen sind in der Lage, Probleme und deren Lösungen zielgruppengerecht und auch in einer Fremdsprache aufzubereiten und darzustellen.
- Die Absolventinnen und Absolventen können physikalische und technische Methoden weitgehend selbstständig auf konkrete Aufgabenstellungen der Nanostrukturwissenschaften anwenden, Lösungswege entwickeln und die Ergebnisse bewerten und interpretieren.
- Die Absolventinnen und Absolventen kennen die wichtigsten Anforderungen und Arbeitsweisen im industriellen Umfeld der Nanowissenschaften.
- Die Absolventinnen und Absolventen kennen die wichtigsten Anforderungen und Arbeitsweisen in Forschung und Entwicklung.
- Die Absolventinnen und Absolventen sind befähigt, komplexe Probleme zu analysieren und zu lösen und sich sehr schnell auch in weniger vertraute Themenkomplexe einzuarbeiten.

Persönlichkeitsentwicklung

UNIVERSITÄT

WÜRZBURG

- Die Absolventinnen und Absolventen kennen die Regeln guter wissenschaftlicher Praxis und beachten sie.
- Die Absolventinnen und Absolventen sind in der Lage, ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darzustellen und zu vertreten.

Befähigung zum gesellschaftlichen Engagement

- Die Absolventinnen und Absolventen können naturwissenschaftliche Entwicklungen kritisch reflektieren und deren Auswirkungen auf die Wirtschaft, Gesellschaft und die Umwelt erfassen (Technikfolgenabschätzung).
- Die Absolventinnen und Absolventen haben ihr Wissen bezüglich wirtschaftlicher, gesellschaftlicher, naturwissenschaftlicher, kultureller etc. Fragestellungen erweitert und können begründet Position beziehen.
- Die Absolventinnen und Absolventen haben die Bereitschaft und Fähigkeit entwickelt, ihre Kompetenzen in partizipative Prozesse einzubringen und aktiv an Entscheidungen mitzuwirken.

Abbreviations used

Course types: \mathbf{E} = field trip, \mathbf{K} = colloquium, \mathbf{O} = conversatorium, \mathbf{P} = placement/lab course, \mathbf{R} = project, \mathbf{S} = seminar, \mathbf{T} = tutorial, $\ddot{\mathbf{U}}$ = exercise, \mathbf{V} = lecture

Term: **SS** = summer semester, **WS** = winter semester

Methods of grading: **NUM** = numerical grade, **B**/**NB** = (not) successfully completed

Regulations: **(L)ASPO** = general academic and examination regulations (for teaching-degree programmes), **FSB** = subject-specific provisions, **SFB** = list of modules

Other: **A** = thesis, **LV** = course(s), **PL** = assessment(s), **TN** = participants, **VL** = prerequisite(s)

Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

In accordance with

the general regulations governing the degree subject described in this module catalogue:

ASPO2015

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

12-Aug-2015 (2015-81)

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 credits	Method of grading	page
Compulsory Courses (118	ECTS credits)			
Nanostructure Technolog	ry (27 ECTS credits)			
11-N-EIN-152-m01	Introduction to Nanoscience	7	NUM	117
11-N-IP-152-m01	Industrial Internship	10	NUM	119
o8-AC-ExChem-152-mo1	Experimental Chemistry	5	NUM	22
08-ACP-NF-152-m01	General and Analytical Chemistry for students of natural sciences (lab)	2	B/NB	27
08-OC-NF-152-m01	Organic Chemistry for students of medicine, biomedicine, den- tal medicine and natural sciences	3	NUM	39
Classical Physics (16 ECT	S credits)			
11-E-M-152-m01	Classical Physics 1 (Mechanics)	8	NUM	87
11-E-E-152-m01	Classical Physics 2 (Heat and Electromagnetism)	8	NUM	80
Optics and Quantum Phy	sics I (6 ECTS credits)			
11-E-OAV-152-m01	Optics and Quantum Physics	6	NUM	93
Optics and Quantum Phy			<u> </u>	
11-E-OA-152-m01	Optics and Waves - Exercises	5	NUM	92
11-E-AA-152-m01	Atoms and Quanta - Exercises	5	NUM	77
Solid State Physics (8 EC		,		
11-E-F-152-m01	Introduction to Solid State Physics	8	NUM	83
Theoretical Physics I (6 E		0	Nom	رہ
11-T-QS-152-mo1	Quantum Mechanics and Statistical Physics	6	NUM	144
Theoretical Physics II (10		0	NOM	144
11-T-QA-152-mo1	Quantum Mechanics - Exercises	-	NUM	4/2
	-	5	-	142
11-T-SA-152-mo1	Statistical Physics - Exercises	5	NUM	146
Mathematics (24 ECTS cr				<u> </u>
10-M-PHY1-152-m01	Mathematics 1 for Students of Physics and Nanostructure Technology	8	NUM	57
10-M-PHY2-152-m01	Mathematics 2 for Students of Physics and Nanostructure Technology	8	NUM	58
11-M-D-152-m01	Mathematics 3 for Students of Physics and related Disciplines (Differential Equations)	8	NUM	109
Laboratory Course Physic	cs (11 ECTS credits)		<u>.</u>	
11-P-PA-152-m01	Laboratory Course Physics A (Mechanics, Heat, Electromagne- tism)	3	B/NB	129
11-P-NB-152-m01	Laboratory Course Physics B (Classical Physics, Electricity, Cir- cuits)	4	B/NB	127
11-P-NC-152-m01	Advanced Laboratory Course Physics C (Modern Physics, Computer Aided Experiments)	4	B/NB	128
Compulsory Electives (32				
Semiconductor Electronic				
11-EL-152-m01	Electronic Circuits	6	NUM	85
11-SPD-152-m01	Physics of Semiconductor Devices	6	NUM	136
11 51 5 152-1101				
11-HLF-152-m01	Semiconductor Lasers and Photonics	6	NUM	97

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Current Topics in Nanost		2		1
08-FU-EEW-152-m01	Electrochemical Energy Storage and Conversion	5	NUM	2
11-LVW-152-m01	Introduction to Labview	6	NUM	10
11-LMT-152-mo1	Laboratory and Measurement Technology	6	NUM	10
11-KVM-152-mo1	Principles of Pattern Classification	3	NUM	10
11-EBV-152-m01	Principles of Image Processing	3	NUM	7
11-ASI-152-m01	Imaging Sensors in Infrared	3	NUM	6
11-2DR-152-m01 11-BMS-152-m01	Imaging Methods at the Synchroton	6	NUM	12
11-ZDR-152-mo1	Principles of Two- and Three-Dimensional Röntgen Imaging	6	NUM	1
11-T-E-152-m01 Applied Physics	Electrodynamics	8	NUN	13
11-T-M-152-m01			NUM NUM	1/
11-M-F-152-m01	Mathematics 4 for Students of Physics and related Disciplines (Complex Analysis) Theoretical Mechanics	8	NUM	1
10-M-COM-152-m01	Computational Mathematics	4	B/NB	5
10-M-PRG-152-m01	Programming course for students of Mathematics and other subjects	3	B/NB	5
10-M-NUM2af-152-m01	Numerical Mathematics 2 for students of other subjects	10	NUM	5
10-M-NUM1af-152-m01	Numerical Mathematics 1 for students of other subjects	10	NUM	5
11-SDC-152-m01	Statistics, Data Analysis and Computer Physics	4	NUM	1
	l Computer Aided Methods			
11-LMB-152-m01	Laboratory and Measurement Technology in Biophysics	6	NUM	10
07-5S2MZ4-152-m01	Specific Biotechnology 2	10	NUM	1
07-4S1MZ1-152-m01	Basics in Light- and Electron-Microscopy	5	NUM	1
07-4S1MZ6-152-m01	Special Bioinformatics 1	5	NUM	1
07-4S1MOLB-152-m01	Aspects of Molecular Biotechnology	5	NUM	1
07-4S1AMB-152-m01	Methods in Biotechnology	5	NUM	1
07-4BFPS2-152-m01	Membranebiology of Plants for Advanced Students	5	NUM	1
Life Sciences				
11-ZMB-152-m01	Methods of Non-Destructive Material Testing	4	NUM	1/
08-FU-NT-AA-152-m01	Chemical Nanotechnology: Analytics and Applications	5	NUM	3
08-FU-MaWi2-152-m01	Material Science 2 (The Material Groups)	5	NUM	3
08-FU-MaWi1-152-m01	Material Science 1 (Basic introduction)	5	NUM	3
08-PCM3-152-m01	Nanoscale Materials	5	NUM	5
08-FU-NT-152-m01	Chemically and bio-inspired Nanotechnology for Material Syn- thesis	5	NUM	3
-	Molecular Materials (Lecture)	5	NUM	3
11-BVG-152-m01	Coating Technologies based on Vapour Deposition	5	NUM	6
11-PPT-152-m01	Laboratory Course Physical Technology of Material Synthesis	8	B/NB	1
11-NTE-152-m01	Nanotechnology in Energy Research	6	NUM	12
11-ENT-152-m01	Principles of Energy Technologies	6	NUM	9
11-NAN-152-m01	Nanoanalytics	6	NUM	1
Materials Science		0	Nom	
11-BXN6A-152-m01	Current Topics in Semiconductor Electronics	6	NUM	6
11-HLP-152-m01 11-KDS-152-m01	Fundamentals of Semiconductor Physics Crystal Growth, thin Layers and Lithography	6	NUM NUM	9 10

11-BXN5-152-m01	Current Topics in Nanostructure Technology	5	NUM	67
11-BXN6-152-m01	Current Topics in Nanostructure Technology	6	NUM	68
11-BXN8-152-m01	Current Topics in Nanostructure Technology	8	NUM	70
11-BXP8-152-m01	Current Topics in Physics	8	NUM	73
11-BXP6-152-m01	Current Topics in Physics	6	NUM	72
11-BXP5-152-m01	Current Topics Physics	5	NUM	71
11-CSN6-152-m01	Selected Topics in Nanostructure Technology	6	NUM	76
11-CSF6-152-m01	Selected Topics in Solid State Physics	6	NUM	75
11-CSEM6-152-m01	Selected Topics in Energy and Material Science	6	NUM	74
11-NTP-152-m01	Novel Transport Phenomena	6	NUM	122
Key Skills Area (20 ECTS c	redits)			
transferable skills (ASQ). General Key Skills (sub	es listed below, students may also take modules offered by JMU a ject-specific)			
•				
11-P-VKM-152-m01	Preparatory Course Mathematics	2	B/NB	132
11-FFI-152-m01	Fit for Industry	3	NUM	96
11-PMP-152-m01	Project Management in Practice	3	B/NB	126
07-SQF-BGA-152-m01	Biotechnology and Social Acceptance	3	NUM	20
11-NASQ5-152-m01	General Competences for Students of Nanostructure Technolo- gy	5	NUM	116
Subject-specific Key Skil	ls (15 ECTS credits)			•
11-M-MR-152-m01	Mathematical Methods of Physics	6	B/NB	113
11-N-HS-152-m01	Seminar Nanostructure Technology	5	NUM	118
11-P-FR1-152-m01	Data and Error Analysis	2	B/NB	123
11-P-FR2-152-m01	Advanced and Computational Data Analysis	2	B/NB	125
Thesis (10 ECTS credits)				
11-BA-N-152-m01	Bachelor Thesis Nanostructure Technology	10	NUM	63
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Module coordi holder of the C	logy of Plants for Advand	ced Students		07-4BFPS2-152-m01
holder of the C	nator			07-4011 32-152-1101
holder of the C	Πατυι		Module offered by	<u> </u>
	hair of Plant Physiology	and Biophysics	Faculty of Biology	
	d of grading	Only after succ. com	, .,	
	ical grade		•	
Duration	Module level	Other prerequisites		
1 semester	undergraduate			
Contents				
methods with		rised. For this purpos	e, students will be i	ane transport and the biophysical ntroduced to modern methods of
Intended learn	ing outcomes			
	erstand basic membrane act plants, isolated plan			experimental methods in experi- ms.
Courses (type,	number of weekly conta	ct hours, language —	if other than Germa	an)
V (1) + Ü (5)				
	essment (type, scope, la on on whether module ca			ation offered — if not every seme-
	naximum of 4 hours). be informed about the mo conus	ethod and length of t	he assessment prior	r to the course.
Allocation of p	laces			
Students of the sideration. Sho ted to students nimum of one 60 ECTS credit tentially to stuct the number of there be, within form regulation ponent that ar ve successfully tial considerat A waiting list ve Selection proc	e Bachelor's degree subj ould the module be used s of the Bachelor's degre place in total) will be allo s and to students of the ics), each with 180 ECTS dents of other 'importing applications, the remain n one module componer n for the courses of one r e concerned will be alloc y completed at least one ion. vill be maintained and pl ess group 1 (95%): Place	ect Biologie (Biology) I in other subjects, the subject Biologie (Biology) Docated to students of Bachelor's degree su credits, as part of the g' subjects). Should the ing places will be all not, several courses wi module component. I cated in the same pro- other module component acces re-allocated as the swill primarily be all	with 180 ECTS cred ere will be two quot iology) with 180 ECT the Bachelor's degr bjects Computation e application-oriente ne number of places ocated to applicants th a restricted numb n this case, places of cedure. In this proce- onent of the respecti- they become availab ocated according to	es will be allocated as follows: lits will be given preferential con- as: 95% of places will be alloca- 'S credits and 5% of places (a mi- ree subject Biologie (Biology) with al Mathematics and Mathema- ed subject Biology (as well as po- s available in one quota exceed as from the other quota. Should ber of places, there will be a uni- on all courses of a module com- edure, applicants who already ha ive module will be given preferen- ole. the applicants' previous acade- number of ECTS credits they ha-

to their total number of ECTS credits achieved (quantitative ranking). The applicants' position in a third ranking will be calculated as the sum of these two rankings, and places will be allocated according to this third ranking. Among applicants with the same ranking, places will be allocated according to the qualitative ranking or otherwise by lot.

Selection process group 2 (5%): Places will be allocated according to the following quotas: Quota 1 (50 % of places): total number of ECTS credits already achieved in modules/module components of the Faculty of Biology; among applicants with the same number of ECTS credits achieved, places will be allocated by lot. Quota 2 (25 % of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. Quota 3 (25 % of places): lottery.

Should the module be used only in the Bachelor's degree subject Biologie (Biology) with 180 ECTS credits, places will be allocated according to the selection process of group 1.

Additional information

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Workload

150 h

Teaching cycle

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

Module appears in

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

Bachelor's degree (1 major) Biology (2017)

Bachelor's degree (1 major) Nanostructure Technology (2020)

Bachelor's degree (1 major) Biology (2021)

Bachelor's degree (1 major) Quantum Technology (2021)

Bachelor's degree (1 major) Biology (2022)

exchange program Biosciences (2022)

Modul	e title				Abbreviation	
Metho	ds in Bi	otechnology			07-4S1AMB-152-mc)1
Modul	e coord	inator		Module offered by	<u>I</u>	
holder	of the (Chair of Biotechnology a	nd Biophysics	Faculty of Biology		
ECTS		od of grading	Only after succ. cor	npl. of module(s)		
5	nume	rical grade				
Durati	-	Module level	Other prerequisites	5		
1 seme		undergraduate				
techno lysis o scence	odule (ology an f biolog e spectr	lecture and seminar) will d biomedicine and the u ical matter on the molec oscopy, electron microso ning outcomes	Inderlying physical p ular and cellular leve	rinciples. It will discu l. These methods inc	iss modern methods lude light microscop	s for the ana- by, fluore-
		gain an overview of key r	nethods in hiotechno	logy and their respe	ctive advantages an	d disadvan-
		ill learn to decide what m				
Course	es (type	, number of weekly conta	act hours, language –	– if other than Germa	ın)	
V (2) +	S (2)					
		sessment (type, scope, la ion on whether module c			tion offered — if not	every seme-
	n exami able for	nation (approx. 30 to 60 bonus	minutes)			
Alloca	tion of _l	olaces				
sidera ted to nimum 60 ECI tik (Ma tential the nu there b form re ponen ve suc tial col A waiti Select mic ac ve ach in the at the averag to thei will be Among se by l	tion. Sh student n of one IS credit athemat ly to stu mber of be, with egulation t that at cessfull nsideration ing list v ion proof hievem ieved a subject time of ge grade r total n e calcula g applic lot.	the Bachelor's degree sub ould the module be used place in total) will be all ts and to students of the cics), each with 180 ECTS udents of other 'importin applications, the remain in one module compone on for the courses of one re concerned will be allow by completed at least one tion. will be maintained and p cess group 1 (95%): Place ents. For this purpose, a nd their average grade o of Biologie (Biology) (ex application. This will be e weighted according to t umber of ECTS credits an ted as the sum of these ants with the same ranking cess group 2 (5%): Place	d in other subjects, the ee subject Biologie (E located to students o Bachelor's degree subjects). Should to ning places will be al nt, several courses w module component. cated in the same pro- e other module comp laces re-allocated as es will primarily be al pplicants will be rank f all assessments tak cluding Chemie (Che done as follows: First the number of ECTS ci- chieved (quantitative two rankings, and pla- ing, places will be all	here will be two quot Biology) with 180 ECT f the Bachelor's degr ubjects Computation e application-oriente the number of places located to applicants with a restricted numb in this case, places of ocedure. In this proce onent of the respection they become available located according to the they decome available located according to the teen during their studi mistry), Physik (Physit, applicants will be read readits (qualitative ran ranking). The applic aces will be allocated ocated according to the	as: 95% of places wi S credits and 5% of ee subject Biologie al Mathematics and d subject Biology (a available in one que from the other quo ber of places, there w on all courses of a m edure, applicants wh ve module will be give one. the applicants' prev number of ECTS creates es or of all module of ics), Mathematik (M anked, firstly, accord hking) and, secondly ants' position in a th d according to this th the qualitative ranki	ill be alloca- places (a mi- (Biology) with Mathema- is well as po- ota exceed ta. Should vill be a uni- odule com- no already ha- ven preferen- vious acade- dits they ha- components athematics)) ding to their y, according nird ranking. ng or otherwi-
ces): t	otal nur	nber of ECTS credits alre	ady achieved in mod	_	nents of the Faculty	- ,
2015)	s with 1 lild	Jor Nanostructure Technology		lor (180 ECTS) Nanostrukturte		page 10 / 150

among applicants with the same number of ECTS credits achieved, places will be allocated by lot. Quota 2 (25 % of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. Quota 3 (25 % of places): lottery.

Should the module be used only in the Bachelor's degree subject Biologie (Biology) with 180 ECTS credits, places will be allocated according to the selection process of group 1.

Additional information

Workload

150 h

Teaching cycle

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

Module appears in

Bachelor's degree (1 major) Biology (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Biology (2017) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Biology (2021) Bachelor's degree (1 major, 1 minor) Biology (Minor, 2021) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Biology (2022) exchange program Biosciences (2022) Bachelor's degree (1 major) Mathematics (2023)

Module	e title				Abbreviation			
Aspect	s of Molecu	ılar Biotechnology			07-4S1MOLB-152-m01			
Module	e coordinat	or		Module offered by				
holder	of the Chai	r of Biotechnology an	d Biophysics	Faculty of Biology				
ECTS	Method of		Only after succ. com	npl. of module(s)				
5	numerical	-						
Duratio	· · · · · · · · · · · · · · · · · · ·	dule level	Other prerequisites					
	ı semester undergraduate							
Conten								
mes, pi sor des	roduction o	f biomolecules, mole esign, drug targeting	cular biology, recom	binant DNA technolo	nobilisation of cells and enzy- ogy, protein engineering, biosen- ibodies, hybridoma technology,			
Intende	ed learning	outcomes						
ges and Studen dently to inde	d disadvant its will acqu review relev pendently a	tages. They will learn uire a knowledge of fu vant literature. In adc acquaint themselves	to decide what meth Indamental methods	od is most suitable in biotechnology th ne acquainted with - anisms.	ogy and their respective advanta- for addressing a particular issue. at will enable them to indepen- or, where necessary, will be able n)			
V (2) +	S (2)							
ster, in written credita	formation o	on whether module ca on (approx. 30 to 60 i us	an be chosen to earn		tion offered — if not every seme-			
25 plac		25						
Should Studen siderat ted to s nimum 60 ECT tik (Ma tentiall the nur there b form re ponent ve succ	I the number its of the Ba ion. Should students of of one place S credits ar thematics), y to studen mber of app re, within or gulation for that are co	achelor's degree subj I the module be used the Bachelor's degree the in total) will be allo to students of the each with 180 ECTS ts of other 'importing blications, the remain me module componer r the courses of one r oncerned will be alloc mpleted at least one	ect Biologie (Biology) in other subjects, th e subject Biologie (B ocated to students of Bachelor's degree su credits, as part of the g' subjects). Should th ing places will be all nt, several courses wi nodule component. I ated in the same pro) with 180 ECTS cred ere will be two quota iology) with 180 ECT the Bachelor's degr bjects Computation application-oriente he number of places ocated to applicants th a restricted numb n this case, places o cedure. In this proce	es will be allocated as follows: its will be given preferential con- as: 95% of places will be alloca- S credits and 5% of places (a mi- ee subject Biologie (Biology) with al Mathematics and Mathema- d subject Biology (as well as po- available in one quota exceed from the other quota. Should ber of places, there will be a uni- on all courses of a module com- edure, applicants who already ha- ve module will be given preferen-			
A waitin Selection mic ach ve ach in the s at the t average to their	ng list will b on process hievements leved and th subject of B time of appl e grade wei r total numb	be maintained and pl group 1 (95%): Place . For this purpose, ap heir average grade of iologie (Biology) (exc lication. This will be o ghted according to th per of ECTS credits ac	oplicants will be rank all assessments take luding Chemie (Chen done as follows: First ne number of ECTS cr hieved (quantitative	ocated according to ed according to the r en during their studi nistry), Physik (Phys , applicants will be r edits (qualitative rar ranking). The applic	ole. the applicants' previous acade- number of ECTS credits they ha- es or of all module components ics), Mathematik (Mathematics)) anked, firstly, according to their nking) and, secondly, according ants' position in a third ranking d according to this third ranking.			

Among applicants with the same ranking, places will be allocated according to the qualitative ranking or otherwise by lot.

Selection process group 2 (5%): Places will be allocated according to the following quotas: Quota 1 (50 % of places): total number of ECTS credits already achieved in modules/module components of the Faculty of Biology; among applicants with the same number of ECTS credits achieved, places will be allocated by lot. Quota 2 (25 % of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. Quota 3 (25 % of places): lottery.

Should the module be used only in the Bachelor's degree subject Biologie (Biology) with 180 ECTS credits, places will be allocated according to the selection process of group 1.

Additional information

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Workload

150 h

Teaching cycle

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

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Module appears in

	Bachelor's degree (1 major) Biology (2015)
	Bachelor's degree (1 major) Mathematics (2015)
	Bachelor's degree (1 major) Nanostructure Technology (2015)
	Bachelor's degree (1 major) Computational Mathematics (2015)
	Master's degree (1 major) Functional Materials (2016)
	Bachelor's degree (1 major) Biology (2017)
	Bachelor's degree (1 major) Nanostructure Technology (2020)
	Bachelor's degree (1 major) Biology (2021)
	Bachelor's degree (1 major, 1 minor) Biology (Minor, 2021)
	Bachelor's degree (1 major) Quantum Technology (2021)
	Bachelor's degree (1 major) Biology (2022)
	Master's degree (1 major) Functional Materials (2022)
	exchange program Biosciences (2022)
	Bachelor's degree (1 major) Mathematics (2023)
	Master's degree (1 major) Functional Materials (2025)
ľ	

Modul	e title				Abbreviation
Basics	in Ligi	nt- and Electron-Microsc	ору		07-4S1MZ1-152-m01
Modul	e coord	linator		Module offered by	<u>I</u>
head o	of the D	epartment of Electronmi	croscopy	Faculty of Biology	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
5	nume	erical grade			
Durati	on	Module level	Other prerequisites		
1 seme	ester	undergraduate			
Conte	nts				
Funda	mental	principles of confocal la	ser scanning microsco	opy and electron mic	croscopy.
Intend	led lear	ning outcomes			
Stude	nts hav	e acquired theoretical kr	nowledge and practica	al skills in the area o	f light and electron microscopy.
		, number of weekly cont			
V (1) +					
		sessment (type, scope, l ion on whether module			ation offered — if not every seme-
	n exami able for	nation (approx. 30 to 60 bonus	minutes)		
Alloca	tion of	places			
Studen sidera ted to nimum 60 ECT tik (Ma tential	d the nu nts of th tion. Sh studen n of one TS cred athema lly to st	ne Bachelor's degree sub nould the module be use ts of the Bachelor's degr e place in total) will be al its and to students of the tics), each with 180 ECTS udents of other 'importir	pject Biologie (Biology d in other subjects, th ee subject Biologie (E located to students of Bachelor's degree su credits, as part of th g' subjects). Should t) with 180 ECTS creations here will be two quot biology) with 180 ECT f the Bachelor's degr ubjects Computation e application-oriente he number of places	es will be allocated as follows: lits will be given preferential con- as: 95% of places will be alloca- S credits and 5% of places (a mi- ree subject Biologie (Biology) with al Mathematics and Mathema- ed subject Biology (as well as po- s available in one quota exceed s from the other quota. Should

there be, within one module component, several courses with a restricted number of places, there will be a uniform regulation for the courses of one module component. In this case, places on all courses of a module component that are concerned will be allocated in the same procedure. In this procedure, applicants who already have successfully completed at least one other module component of the respective module will be given preferential consideration.

A waiting list will be maintained and places re-allocated as they become available.

Selection process group 1 (95%): Places will primarily be allocated according to the applicants' previous academic achievements. For this purpose, applicants will be ranked according to the number of ECTS credits they have achieved and their average grade of all assessments taken during their studies or of all module components in the subject of Biologie (Biology) (excluding Chemie (Chemistry), Physik (Physics), Mathematik (Mathematics)) at the time of application. This will be done as follows: First, applicants will be ranked, firstly, according to their average grade weighted according to the number of ECTS credits (qualitative ranking) and, secondly, according to their total number of ECTS credits achieved (quantitative ranking). The applicants' position in a third ranking will be calculated as the sum of these two rankings, and places will be allocated according to this third ranking. Among applicants with the same ranking, places will be allocated according to the qualitative ranking or otherwise by lot.

Selection process group 2 (5%): Places will be allocated according to the following quotas: Quota 1 (50 % of places): total number of ECTS credits already achieved in modules/module components of the Faculty of Biology; among applicants with the same number of ECTS credits achieved, places will be allocated by lot. Quota 2 (25 % of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. Quota 3 (25 % of places): lottery.

Bachelor's with 1 major Nanostructure Technology	JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-
(2015)	ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015

Should the module be used only in the Bachelor's degree subject Biologie (Biology) with 180 ECTS credits, places will be allocated according to the selection process of group 1.

Additional information

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Workload

150 h

Teaching cycle

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

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Module appears in

Bachelor's degree (1 major) Biology (2015)
Bachelor's degree (1 major) Mathematics (2015)
Bachelor's degree (1 major) Nanostructure Technology (2015)
Bachelor's degree (1 major) Computational Mathematics (2015)
Bachelor's degree (1 major, 1 minor) Biology (Minor, 2015)
Bachelor's degree (1 major) Biology (2017)
Bachelor's degree (1 major) Nanostructure Technology (2020)
Bachelor's degree (1 major) Biology (2021)
Bachelor's degree (1 major, 1 minor) Biology (Minor, 2020)
Bachelor's degree (1 major) Quantum Technology (2021)
Bachelor's degree (1 major) Biology (2022)
exchange program Biosciences (2022)

Specia	e title				Abbreviation	
	ll Bioinformatics 1				07-4S1MZ6-152-mo	01
Modul	e coordinator			Module offered by		
holder	of the Chair of Bioir	formatics		Faculty of Biology		
ECTS	Method of grading	5	Only after succ. con	npl. of module(s)		
5	numerical grade			•		
Duratio	on Module leve	el	Other prerequisites	;		
1 seme	ester undergradu	ate				
Conten	nts					
damen			ife, fundamental prin ology (concepts), seq			
Intend	ed learning outcom	es				
	nts are able to use se econstruction.	oftware and	databases for seque	nce analysis, RNA st	ructure prediction ar	nd phyloge-
Course	es (type, number of v	veekly conta	act hours, language –	- if other than Germa	an)	
V (1) +	Ü (5)					
			anguage — if other th an be chosen to earn		ation offered — if not	every seme-
Langua	oprox. 10 to 20 page age of assessment: (able for bonus		nglish			
	tion of places		-			
siderat ted to s nimum 60 ECT	tion. Should the mod students of the Bach of one place in tota S credits and to stud	dule be used nelor's degre Il) will be all	ject Biologie (Biology d in other subjects, th ee subject Biologie (B ocated to students of	nere will be two quot Biology) with 180 EC	as: 95% of places wi S credits and 5% of	
tentiall the num there b form re ponent ve succe tial cor A waiti Selecti mic acl ve achi in the s at the t averag to thein will be Among se by le Selecti	ly to students of oth mber of applications be, within one modu egulation for the cou t that are concerned cessfully completed nsideration. Ing list will be maint ion process group 1 hievements. For this ieved and their aver subject of Biologie (time of application. ge grade weighted ac r total number of EC calculated as the su gapplicants with the ot.	th 180 ECTS er 'importing s, the remain le compone rses of one will be alloo at least one ained and p (95%): Place purpose, aj age grade of Biology) (exi This will be cording to t TS credits ac um of these e same ranki (5%): Places	credits, as part of the g' subjects). Should the ning places will be all nt, several courses we module component. Cated in the same pro- e other module compo- laces re-allocated as es will primarily be all pplicants will be rank f all assessments tak cluding Chemie (Cher done as follows: First he number of ECTS cre chieved (quantitative two rankings, and pla ng, places will be allocated acc	abjects Computation e application-oriented the number of places located to applicant ith a restricted number of the restricted number of the scase, places onent of the respect they become availa located according to the according to the en during their stud mistry), Physik (Physic, applicants will be redits (qualitative ra ranking). The applic aces will be allocate boated according to the follow	al Mathematics and ed subject Biology (a s available in one que s from the other quot ber of places, there we on all courses of a me edure, applicants whi ive module will be give ble. the applicants' prev number of ECTS cred ies or of all module c sics), Mathematik (Ma ranked, firstly, accord nking) and, secondly cants' position in a th d according to this the the qualitative ranking	(Biology) with Mathema- s well as po- ota exceed ta. Should vill be a uni- odule com- no already ha ven preferen vious acade- lits they ha- components athematics)) ding to their v, according nird ranking nird ranking. ng or otherwi
tentiall the num there b form re- ponent ve succ tial cor A waiti Selecti mic acl ve achi in the s at the t averag to thein will be Among se by lo Selecti ces): to	ly to students of oth mber of applications be, within one modu egulation for the cou t that are concerned cessfully completed nsideration. Ing list will be maint ion process group 1 hievements. For this ieved and their aver subject of Biologie (time of application. ge grade weighted ac r total number of EC calculated as the su gapplicants with the ot.	th 180 ECTS er 'importing s, the remain le compone rses of one will be alloo at least one ained and p (95%): Place purpose, af age grade of Biology) (exe this will be cording to t TS credits ac um of these same ranki (5%): Places credits alrea	credits, as part of the g' subjects). Should the ning places will be all nt, several courses we module component. Cated in the same pro- eated in the same pro-	abjects Computation e application-oriented the number of places located to applicant ith a restricted number of the restricted number of the scase, places onent of the respect they become availa located according to the according to the en during their stud mistry), Physik (Physic, applicants will be redits (qualitative ra ranking). The applic aces will be allocate boated according to the follow	al Mathematics and ed subject Biology (a s available in one que s from the other quot ber of places, there we on all courses of a me edure, applicants whi ive module will be give ble. the applicants' prev number of ECTS cred ies or of all module co sics), Mathematik (Ma ranked, firstly, accord nking) and, secondly cants' position in a the d according to this the the qualitative ranking ring quotas: Quota 1 nents of the Faculty of	(Biology) wit Mathema- s well as po- ota exceed ta. Should vill be a uni- odule com- to already ha ven preferen vious acade- dits they ha- components athematics)) ding to their v, according hird ranking. ng or otherw (50 % of pla-

among applicants with the same number of ECTS credits achieved, places will be allocated by lot. Quota 2 (25 % of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. Quota 3 (25 % of places): lottery.

Should the module be used only in the Bachelor's degree subject Biologie (Biology) with 180 ECTS credits, places will be allocated according to the selection process of group 1.

Additional information

Workload

150 h

Teaching cycle

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

Module appears in

Bachelor's degree (1 major) Biology (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major, 1 minor) Biology (Minor, 2015) Bachelor's degree (1 major) Biology (2017) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Biology (2021) Bachelor's degree (1 major, 1 minor) Biology (Minor, 2020) Bachelor's degree (1 major, 1 minor) Biology (Minor, 2020) Bachelor's degree (1 major, 1 minor) Biology (Minor, 2021) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Biology (2022) exchange program Biosciences (2022) Bachelor's degree (1 major) Mathematics (2023)

Module	e title				Abbreviation
	c Biotechnology 2				07-5S2MZ4-152-m01
	e coordinator			Module offered by	
	of the Chair of Biotechn	ology an		Faculty of Biology	
ECTS	Method of grading		Only after succ. com	pl. of module(s)	
10	numerical grade				
Duratio			Other prerequisites		
1 seme					
Under e lar biot scence	actical course provides s expert guidance, studen	ts will p icrosyste	erform selected expe ems biotechnology, b	riments on the follow piomaterials and bios	ogical and biophysical topics. wing topics: cellular and molecu- sensors, high-resolution fluore- on of cells.
applica acquai chanisi tools. I have do	ations that will enable th nted with - or, where neo ms. Students will have a	em to in cessary, icquired will hav ation (15	dependently review will be able to indep practical experience e acquired detailed t minutes) on one of t	relevant literature. Ir endently acquaint th performing experim heoretical knowledg he experiments they	·
Ü (7) +		ly conta	ci ilouis, laliguage –	- II Other than Germa	11)
Module	e taught in: German and				
	d of assessment (type, s formation on whether m	•			tion offered — if not every seme-
b) log (c) oral d d) oral e) pres f) pract not exc Studen Langua	en examination (approx approx. 10 to 20 pages) examination of one can examination in groups of entation (approx. 20 to ical examination (on ave eed a maximum of 4 ho ts will be informed about age of assessment: Germ ble for bonus	or didate ea of up to <u>3</u> 30 minu erage ap urs). ut the mo	ach (approx. 30 minu 3 candidates (approx tes) or prox. 2 hours; time to ethod and length of t	. 20 minutes per can o complete will vary	according to subject area but will
Allocat	ion of places				
Studen siderat ted to s nimum 60 ECT tik (Ma tentiall the nur there b form re ponent ve succ	the number of applicati its of the Bachelor's deg ion. Should the module students of the Bachelor of one place in total) wi S credits and to student thematics), each with 18 y to students of other 'ir nber of applications, the e, within one module co gulation for the courses that are concerned will	ree subj be used 's degre Il be allo s of the Bo ECTS mporting e remain omponer of one r be alloc	ect Biologie (Biology) in other subjects, th e subject Biologie (B ocated to students of Bachelor's degree su credits, as part of the g' subjects). Should th ing places will be all nt, several courses wi nodule component. I ated in the same pro) with 180 ECTS cred ere will be two quota iology) with 180 ECT the Bachelor's degr bjects Computation application-oriente he number of places ocated to applicants ith a restricted numb n this case, places o cedure. In this proce	es will be allocated as follows: its will be given preferential con- as: 95% of places will be alloca- S credits and 5% of places (a mi- ee subject Biologie (Biology) with al Mathematics and Mathema- d subject Biology (as well as po- available in one quota exceed from the other quota. Should er of places, there will be a uni- n all courses of a module com- edure, applicants who already ha- ve module will be given preferen-

A waiting list will be maintained and places re-allocated as they become available.

Selection process group 1 (95%): Places will primarily be allocated according to the applicants' previous academic achievements. For this purpose, applicants will be ranked according to the number of ECTS credits they have achieved and their average grade of all assessments taken during their studies or of all module components in the subject of Biologie (Biology) (excluding Chemie (Chemistry), Physik (Physics), Mathematik (Mathematics)) at the time of application. This will be done as follows: First, applicants will be ranked, firstly, according to their average grade weighted according to the number of ECTS credits (qualitative ranking) and, secondly, according to their total number of ECTS credits achieved (quantitative ranking). The applicants' position in a third ranking will be calculated as the sum of these two rankings, and places will be allocated according to this third ranking. Among applicants with the same ranking, places will be allocated according to the qualitative ranking or otherwise by lot.

Selection process group 2 (5%): Places will be allocated according to the following quotas: Quota 1 (50 % of places): total number of ECTS credits already achieved in modules/module components of the Faculty of Biology; among applicants with the same number of ECTS credits achieved, places will be allocated by lot. Quota 2 (25 % of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. Quota 3 (25 % of places): lottery.

Should the module be used only in the Bachelor's degree subject Biologie (Biology) with 180 ECTS credits, places will be allocated according to the selection process of group 1.

Additional information

Workload

300 h

Teaching cycle

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

Module appears in

Bachelor's degree (1 major) Biology (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Biology (2017) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Biology (2021) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Biology (2022) exchange program Biosciences (2022)

Modul	e title				Abbreviation	
Biotec	hnolog	y and Social Acceptance			07-SQF-BGA-152-m01	
Modul	e coord	inator		Module offered by		
holder	ofthe	Chair of Plant Physiology	and Biophysics	Faculty of Biology		
ECTS				npl. of module(s)		
3	nume	rical grade				
Durati	on	Module level	Other prerequisites			
1 seme	ester	undergraduate				
Conter	nts					
Applic bility.	ations	of green biotechnology; b	iological background	l, economic interests	s, ecological risks, social accepta	
	ed lear	ning outcomes				
enhan lected	ced the ·	ir oral and written presen	tation skills and are	able to use these to	raised by society. Students have present the data they have col-	
Course	es (type	, number of weekly conta	ict hours, language –	- if other than Germa	an)	
	e taugh	t in: German and/or Engl		an German, examina	tion offered — if not every seme-	
		ion on whether module ca				
Langua		preparing educational m ssessment: German and, bonus		10 pages)		
Alloca	tion of	places				
Studer siderat ted to nimum 60 ECT tik (Ma tential the nu there b form re ponen ve suc	d the nut nts of th tion. Sh studen n of one IS credi athema ly to stu mber o be, with egulatic t that a	the Bachelor's degree subj rould the module be used ts of the Bachelor's degree place in total) will be all ts and to students of the tics), each with 180 ECTS udents of other 'importing f applications, the remain in one module component on for the courses of one of the concerned will be alloce by completed at least one	ject Biologie (Biology I in other subjects, the se subject Biologie (B ocated to students of Bachelor's degree su credits, as part of the g' subjects). Should t hing places will be all ht, several courses w module component. I cated in the same pro-) with 180 ECTS cred here will be two quot sology) with 180 ECT f the Bachelor's degr ubjects Computation e application-oriente he number of places located to applicants ith a restricted numb in this case, places o ocedure. In this proce	es will be allocated as follows: lits will be given preferential con- as: 95% of places will be alloca- S credits and 5% of places (a mi- ree subject Biologie (Biology) with al Mathematics and Mathema- ed subject Biology (as well as po- s available in one quota exceed s from the other quota. Should ber of places, there will be a uni- on all courses of a module com- edure, applicants who already ha- ve module will be given preferen-	
		will be maintained and pl cess group 1 (95%): Place			the applicants' previous acade-	

Selection process group 1 (95%): Places will primarily be allocated according to the applicants' previous academic achievements. For this purpose, applicants will be ranked according to the number of ECTS credits they have achieved and their average grade of all assessments taken during their studies or of all module components in the subject of Biologie (Biology) (excluding Chemie (Chemistry), Physik (Physics), Mathematik (Mathematics)) at the time of application. This will be done as follows: First, applicants will be ranked, firstly, according to their average grade weighted according to the number of ECTS credits (qualitative ranking) and, secondly, according to their total number of ECTS credits achieved (quantitative ranking). The applicants' position in a third ranking will be calculated as the sum of these two rankings, and places will be allocated according to this third ranking. Among applicants with the same ranking, places will be allocated according to the qualitative ranking or otherwise by lot.

Bachelor's with 1 major Nanostructure Technology (2015)

Selection process group 2 (5%): Places will be allocated according to the following quotas: Quota 1 (50 % of places): total number of ECTS credits already achieved in modules/module components of the Faculty of Biology; among applicants with the same number of ECTS credits achieved, places will be allocated by lot. Quota 2 (25 % of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. Quota 3 (25 % of places): lottery.

Should the module be used only in the Bachelor's degree subject Biologie (Biology) with 180 ECTS credits, places will be allocated according to the selection process of group 1.

Additional information

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Workload

90 h

Teaching cycle

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

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Module appears in

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

Bachelor's degree (1 major) Nanostructure Technology (2020)

Bachelor's degree (1 major) Quantum Technology (2021)

Module	e title				Abbreviation	
Experi	mental	Chemistry			o8-AC-ExChem-152	-m01
		•				
Module				Module offered by		
		ture "Experimentalchemi	e" (Experimental	Institute of Inorgani	c Chemistry	
Chemis	1					
ECTS		od of grading	Only after succ. con	npl. of module(s)		
5	I	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	undergraduate				
Conten	nts					
The mo	odule p	rovides an overview of th	e fundamental know	ledge of chemistry. E	mphasis is placed o	on the materi
al and	particle	e level, metals, acid-base	reactions, the period	lic table, chemical e	quilibrium and comp	olexometry.
Intend	ed lear	ning outcomes				
The stu	udent u	nderstands the principle	s of the periodic table	e and can obtain info	rmation from it. He/	she is profi-
cient ir	ı basic	models of the structure of	of matter and can des	cribe them properly.	He/she can depict of	chemical re-
actions	s using	typical chemical formula	language and interp	ret them by identifyir	ng the type of reaction	on.
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	n)	
V (4)						
Metho	d of as	sessment (type, scope, la	anguage — if other th	an German, examina	tion offered — if not	everv seme-
		ion on whether module c				,
written	exami	nation (approx. 90 minut	es)			
		ssessment: German and				
Allocat						
Additic	nal inf	ormation				
Auunt		ormation				
Worklo						
	Jau		-			
150 h						
Teachi						
Teachi	ng cycl	e: every year, winter sem	ester			
Referre	ed to in	LPOI (examination regu	llations for teaching-	degree programmes)		
Module	e appea	ars in				
		gree (1 major) Biology (2	011)			
		gree (1 major) Psycholog				
		gree (1 major, 1 minor) Po				
Bachel	or's de	gree (1 major, 1 minor) Po	olitical and Social Stu	dies (2013)		
Bachel	or's de	gree (1 major, 1 minor) R	ussian Language and	Culture (2008)		
		gree (2 majors) Special E	-			
-		logiae Catholic Theology	-			
<u> </u>	or's de	gree (2 majors) English a		-		
		(•) •		140 100101		
Bachel	or's de	gree (2 majors) German I		ire (2013)		
Bachel Bachel	or's de or's de	gree (1 major) Geography	/ (2015)	ire (2013)		
Bachel Bachel Bachel	or's de or's de or's de	gree (1 major) Geography gree (1 major) Mathemat	/ (2015) ics (2015)	ire (2013)		
Bachel Bachel Bachel Bachel	or's de or's de or's de or's de	gree (1 major) Geography gree (1 major) Mathemat gree (1 major) Musicolog	/ (2015) ics (2015) y (2015)	ire (2013)		
Bachel Bachel Bachel Bachel Bachel	or's de or's de or's de or's de or's de	gree (1 major) Geography gree (1 major) Mathemat gree (1 major) Musicolog gree (1 major) Physics (2	/ (2015) ics (2015) y (2015) 015)	ire (2013)		
Bachel Bachel Bachel Bachel Bachel Bachel	or's de or's de or's de or's de or's de or's de	gree (1 major) Geography gree (1 major) Mathemat gree (1 major) Musicolog	/ (2015) ics (2015) y (2015) 015) y (2015)	generated 18-Apr-2025 • exa		page 22 / 150

Bachelor's degree (1 major) Business Management and Economics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Music Education (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Political and Social Studies (2015) Bachelor's degree (1 major) Functional Materials (2015) Bachelor's degree (1 major) Academic Speech Therapy (2015) Bachelor's degree (1 major) Indology/South Asian Studies (2015) Bachelor's degree (1 major, 1 minor) Egyptology (2015) Bachelor's degree (1 major, 1 minor) Pedagogy (2015) Bachelor's degree (1 major, 1 minor) History (2015) Bachelor's degree (1 major, 1 minor) Musicology (2015) Bachelor's degree (1 major, 1 minor) Philosophy (2015) Bachelor's degree (1 major, 1 minor) Pre- and Protohistoric Archaeology (2015) Bachelor's degree (1 major, 1 minor) Ancient World (2015) Bachelor's degree (1 major, 1 minor) Philosophy and Religion (2015) Bachelor's degree (1 major, 1 minor) Theological Studies (2015) Bachelor's degree (1 major, 1 minor) Political and Social Studies (2015) Bachelor's degree (1 major, 1 minor) Russian Language and Culture (2015) Bachelor's degree (1 major, 1 minor) German Language and Literature (2015) Bachelor's degree (2 majors) Egyptology (2015) Bachelor's degree (2 majors) Pedagogy (2015) Bachelor's degree (2 majors) Protestant Theology (2015) Bachelor's degree (2 majors) Musicology (2015) Bachelor's degree (2 majors) Philosophy (2015) Bachelor's degree (2 majors) Special Education (2015) Bachelor's degree (2 majors) Pre- and Protohistoric Archaeology (2015) Bachelor's degree (2 majors) Latin Philology (2015) Bachelor's degree (2 majors) Music Education (2015) Bachelor's degree (2 majors) Philosophy and Religion (2015) Bachelor's degree (2 majors) Theological Studies (2015) Bachelor's degree (2 majors) Political and Social Studies (2015) Bachelor's degree (2 majors) Russian Language and Culture (2015) Bachelor's degree (2 majors) Greek Philology (2015) Bachelor's degree (2 majors) European Ethnology (2015) Bachelor's degree (2 majors) Indology/South Asian Studies (2015) Bachelor's degree (2 majors) Geography (2015) Bachelor's degree (2 majors) French Studies (2015) Bachelor's degree (2 majors) History (2015) Bachelor's degree (2 majors) Sport Science (Focus on health and Pedagogics in Movement) (2015) Bachelor's degree (2 majors) German Language and Literature (2015) Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major, 1 minor) French Studies (2016) Bachelor's degree (2 majors) French Studies (2016) Bachelor's degree (1 major, 1 minor) Italian Studies (2016) Bachelor's degree (2 majors) Italian Studies (2016) Bachelor's degree (1 major, 1 minor) Spanish Studies (2016) Bachelor's degree (2 majors) Spanish Studies (2016) Bachelor's degree (1 major) Romanic Languages (French/Italian) (2016) Bachelor's degree (1 major) Romanic Languages (French/Spanish) (2016) Bachelor's degree (1 major) Romanic Languages (Italian/Spanish) (2016) Bachelor's degree (1 major) Business Information Systems (2016) Bachelor's degree (1 major) Games Engineering (2016) Bachelor's with 1 major Nanostructure Technology JMU Würzburg • generated 18-Apr-2025 • exam. reg. dapage 23 / 150 (2015) ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015

Bachelor's degree (1 major, 1 minor) English and American Studies (2016) Bachelor's degree (2 majors) English and American Studies (2016) Bachelor's degree (1 major) Media Communication (2016) Bachelor's degree (1 major, 1 minor) Digital Humanities (2016) Bachelor's degree (1 major) Biology (2017) Bachelor's degree (1 major, 1 minor) Geography (2017) Bachelor's degree (1 major, 1 minor) History of Medieval and Modern Art (2017) Bachelor's degree (2 majors) History of Medieval and Modern Art (2017) Bachelor's degree (2 majors) Comparative Indo-European Linguistics (2017) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major, 1 minor) Museology and material culture (2017) Bachelor's degree (1 major) Economathematics (2017) Bachelor's degree (1 major) Games Engineering (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Media Communication (2018) Bachelor's degree (1 major) Biomedicine (2018) Bachelor's degree (1 major) Human-Computer Systems (2018) Bachelor's degree (2 majors) Classical Archaeology (2018) Bachelor's degree (1 major, 1 minor) Classical Archaeology (2018) Bachelor's degree (1 major, 1 minor) Digital Humanities (2018) Bachelor's degree (2 majors) Digital Humanities (2018) Bachelor's degree (1 major) Computer Science (2019) Bachelor's degree (1 major, 1 minor) English and American Studies (2019) Bachelor's degree (1 major) Indology/South Asian Studies (2019) Bachelor's degree (1 major) Business Information Systems (2019) Bachelor's degree (2 majors) Indology/South Asian Studies (2019) Bachelor's degree (1 major) Business Management and Economics (2019) Bachelor's degree (1 major) Modern China (2019) Bachelor's degree (1 major) Biomedicine (2020) Bachelor's degree (1 major) Pedagogy (2020) Bachelor's degree (1 major) Political and Social Studies (2020) Bachelor's degree (1 major) Business Information Systems (2020) Bachelor's degree (1 major, 1 minor) Political and Social Studies (2020) Bachelor's degree (2 majors) European Ethnology (2020) Bachelor's degree (2 majors) Political and Social Studies (2020) Bachelor's degree (2 majors) Special Education (2020) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major, 1 minor) Museology and material culture (2020) Bachelor's degree (1 major, 1 minor) Pedagogy (2020) Bachelor's degree (2 majors) Pedagogy (2020) Bachelor's degree (1 major) Psychology (2020) Bachelor's degree (1 major) Biology (2021) Magister Theologiae Catholic Theology (2021) Bachelor's degree (2 majors) History (2021) Bachelor's degree (1 major, 1 minor) History (2021) Bachelor's degree (1 major) Media Communication (2021) Bachelor's degree (2 majors) Theological Studies (2021) Bachelor's degree (1 major, 1 minor) Theological Studies (2021) Bachelor's degree (1 major, 1 minor) English and American Studies (2021) Bachelor's degree (2 majors) English and American Studies (2021) Bachelor's with 1 major Nanostructure Technology JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-(2015) ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015

Bachelor's degree (1 major) Functional Materials (2021) Bachelor's degree (1 major) Computer Science und Sustainability (2021) Bachelor's degree (2 majors) Comparative Indo-European Linguistics (2021) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (2 majors) Special Education (2021) Bachelor's degree (1 major) Business Information Systems (2021) Bachelor's degree (1 major) Economathematics (2021) Bachelor's degree (1 major) Business Management and Economics (2021) Bachelor's degree (1 major) Human-Computer Systems (2022) Bachelor's degree (1 major, 1 minor) Museology and material culture (2022) Bachelor's degree (1 major) Biology (2022) Bachelor's degree (1 major) Economathematics (2022) Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (2 majors) Ancient Near Eastern Archaeology (2022) Bachelor's degree (1 major, 1 minor) Ancient World (2022) Bachelor's degree (2 majors) Ancient Near Eastern Studies (2022) Bachelor's degree (1 major) Franco-German studies: language, culture, digital competence (2022) Bachelor's degree (1 major) European Law (2023) Bachelor's degree (1 major, 1 minor) English and American Studies (2023) Bachelor's degree (2 majors) English and American Studies (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Business Information Systems (2023) Bachelor's degree (1 major) Economathematics (2023) Bachelor's degree (1 major, 1 minor) History of Medieval and Modern Art (2023) Bachelor's degree (2 majors) History of Medieval and Modern Art (2023) Bachelor's degree (2 majors) Special Education (2023) Bachelor's degree (1 major) Business Management and Economics (2023) Bachelor's degree (1 major) Geography (2023) Bachelor's degree (2 majors) Geography (2023) Bachelor's degree (1 major, 1 minor) Geography (2023) Bachelor's degree (2 majors) European Ethnology/Empiric Cultural Studies (2023) Bachelor's degree (1 major) Mathematical Physics (2024) Bachelor's degree (2 majors) German Language and Literature (2024) Bachelor's degree (1 major, 1 minor) German Language and Literature (2024) Bachelor's degree (1 major) Music Education (2024) Bachelor's degree (2 majors) Music Education (2024) Bachelor's degree (1 major, 1 minor) Music Education (2024) Bachelor's degree (1 major) Indology/South Asian Studies (2024) Bachelor's degree (2 majors) Indology/South Asian Studies (2024) Bachelor's degree (1 major, 1 minor) Indology/South Asian Studies (2024) Bachelor's degree (1 major, 1 minor) Ancient World (2024) Bachelor's degree (2 majors) Digital Humanities (2024) Bachelor's degree (1 major, 1 minor) Digital Humanities (2024) Bachelor's degree (1 major) Midwifery (2024) Bachelor's degree (2 majors) Greek Philology (2024) Bachelor's degree (2 majors) Latin Philology (2024) Bachelor's degree (1 major) Business Information Systems (2024) Bachelor's degree (1 major) Economathematics (2024) Bachelor's degree (1 major) Business Management and Economics (2024) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024) Bachelor's degree (1 major) Human-Computer-Interaction (2024) Bachelor's with 1 major Nanostructure Technology JMU Würzburg • generated 18-Apr-2025 • exam. reg. dapage 25 / 150 (2015) ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015

Bachelor's degree (2 majors) Art Education (2024)

Bachelor's degree (1 major) Digital Business & Data Science (2024)

Bachelor's degree (1 major) Classics (2024)

Bachelor's degree (1 major) Diversity, Ethics and Religions (2024)

Bachelor's degree (1 major) Functional Materials (2025)

Bachelor's degree (1 major) (2025)

Julius-Maxi

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WÜRZBURG

Bachelor's degree (1 major, 1 minor) European Ethnology/Empiric Cultural Studies (2025)

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

Bachelor's degree (2 majors) Pedagogy (2025)

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

Bachelor's degree (1 major) Academic Speech Therapy (2025)

Bachelor's degree (1 major, 1 minor) Pedagogy (2025)

Bachelor's degree (1 major) Games Engineering (2025)

Module	e title				Abbreviation
Genera	l and A	nalytical Chemistry for s	tudents of natural sc	iences (lab)	08-ACP-NF-152-m01
Module	e coord	inator		Module offered	d by
holder	of the (Chair of Anorganic Chemi	stry	Institute of Ino	rganic Chemistry
ECTS		od of grading	Only after succ. com	pl. of module(s	;)
2	(not) s	successfully completed	o8-AC-ExChem		
Duratio	Duration Module level		Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
lated le course	ecture(s focuse	s). After a safety briefing,	the students autonor	nously conduct	dge they have gained through the re- experiments in the laboratory. The of simple substances and analyses of
Intende	ed learı	ning outcomes			
have de	evelope		he necessary stoichi	ometric calculat	rm experiments to solve them. They tions and describe the chemical pro-
Course	s (type	, number of weekly conta	ct hours, language —	if other than G	erman)
P (4)					
ster, in Vortest pages e Langua	formati ate/Na each) a ge of a	on on whether module ca chtestate (pre and post- nd assessment of practic ssessment: German and	an be chosen to earn experiment examinati cal performance (2 to /or English	a bonus) ion talks approx	mination offered — if not every seme- x. 15 minutes each, log approx. 5 to 10 hinations)
Assess	ment o	ffered: Once a year, sum	mer semester		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
60 h					
Teachi	ng cycl	6			
Referre	d to in	LPO I (examination regu	lations for teaching-o	legree program	mes)
				0 1 0 0	
Module	e appea	irs in			
Bachelo Bachelo Bachelo Bachelo	or's de or's de or's de or's de	gree (1 major) Physics (20 gree (1 major) Nanostruct gree (1 major) Physics (20 gree (1 major) Nanostruct gree (1 major) Quantum T	cure Technology (2015 220) cure Technology (2020		

Module	e title				Abbreviation	
Electro	chemica	al Energy Storage and	Conversion		08-FU-EEW-152-m01	L
Modul	e coordi	nator		Module offered by		
			nology of Material Syn-			l Synthocic
thesis	or the C		nology of Material Syn-		echnology of Materia	a synthesis
ECTS	Metho	d of grading	Only after succ. con	npl. of module(s)		
5	1	cal grade		-		
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	its					
um and cal dou	d nickel uble laye	metal hydride, sodiun r capacitors, redox-flo	y systems (aqueous an n sulphur, sodium nick ow batteries, fuel cell sy e solar cell), thermoeled	el chloride, lithium io /stems (AFC, PEMFC,	on accumulators), ele	ectrochemi-
Intend	ed learn	ing outcomes				
		developed a knowled to research problem	ge of electrochemical e s.	nergy storage and co	onversion and are ab	le to apply
Course	es (type,	number of weekly cor	ntact hours, language –	- if other than Germa	n)	
V (2) +	P (1) + E	(1)				
			language — if other the can be chosen to earn		tion offered — if not	every seme
Allocat 	tion of p					
Additio	onal info	rmation				
 Workla	ad					
150 h						
	ng cycle					
	ad to in l	POL (examination ro	gulations for teaching-o	lagraa programmac)		
Referre			<u></u>			
			<u>34</u>			
			34.44.01.010100000000			
 Module	e appeai	rs in				
 Module Bachel	or's deg	r s in ree (1 major) Nanostri	ucture Technology (201			
 Module Bachel Master	or's deg 's degre	r s in ree (1 major) Nanostru e (1 major) Physics (2	ucture Technology (201 016)			
 Module Bachel Master Master	or's deg degre	r s in ree (1 major) Nanostru e (1 major) Physics (2 e (1 major) Nanostruc	ucture Technology (201 016) ture Technology (2016)			
 Module Bachel Master Master Master	or's deg f's degre f's degre	r s in ree (1 major) Nanostri e (1 major) Physics (2 e (1 major) Nanostruc e (1 major) Functional	ucture Technology (201 016) ture Technology (2016) Materials (2016)	5)		
 Module Bachel Master Master Master Master	or's deg f's degre f's degre f's degre f's degre	r s in ree (1 major) Nanostru e (1 major) Physics (2 e (1 major) Nanostruc e (1 major) Functional e (1 major) Nanostruc	ucture Technology (201 016) ture Technology (2016) Materials (2016) ture Technology (2020)	5)		
 Bachel Master Master Master Master Master	or's degre f's degre f's degre f's degre f's degre	r s in ree (1 major) Nanostru e (1 major) Physics (2 e (1 major) Nanostruc e (1 major) Functional e (1 major) Nanostruc e (1 major) Physics (2	ucture Technology (201 016) ture Technology (2016) Materials (2016) ture Technology (2020) 020)	5)		
 Module Bachel Master Master Master Master Master	or's degre ''s degre ''s degre ''s degre ''s degre ''s degre	r s in ree (1 major) Nanostru e (1 major) Physics (2 e (1 major) Nanostruc e (1 major) Functional e (1 major) Nanostruc e (1 major) Physics (2 e (1 major) Physics Int	ucture Technology (201 016) ture Technology (2016) Materials (2016) ture Technology (2020) 020) ternational (2020)	5)		
 Module Bachel Master Master Master Master Master Master	or's degre d's degre d's degre d's degre d's degre degre degre degre	r s in ree (1 major) Nanostru e (1 major) Physics (2 e (1 major) Nanostruc e (1 major) Functional e (1 major) Nanostruc e (1 major) Physics (2 e (1 major) Physics Int e (1 major) Quantum I	ucture Technology (201) 016) ture Technology (2016) Materials (2016) ture Technology (2020) 020) ternational (2020) Engineering (2020)	5)		
 Modul d Master Master Master Master Master Master Bachel	or's degre d's degre d's degre d's degre d's degre degre degre degre dor's degre	r s in ree (1 major) Nanostru e (1 major) Physics (2 e (1 major) Nanostruc e (1 major) Functional e (1 major) Nanostruc e (1 major) Physics (2 e (1 major) Physics Int e (1 major) Quantum I	ucture Technology (201 016) ture Technology (2016) Materials (2016) ture Technology (2020) 020) ternational (2020) Engineering (2020) ucture Technology (202	5)		
 Module Master Master Master Master Master Bachel Bachel	or's degre d's degre d's degre d's degre d's degre d's degre d's degre dor's degre dor's deg	rs in ree (1 major) Nanostru e (1 major) Physics (2 e (1 major) Nanostruc e (1 major) Functional e (1 major) Nanostruc e (1 major) Physics (2 e (1 major) Physics Int e (1 major) Quantum I ree (1 major) Nanostru	ucture Technology (201 016) ture Technology (2016) Materials (2016) ture Technology (2020) 020) ternational (2020) Engineering (2020) ucture Technology (2021)	5)	ım reg da.	page 28 / 15C



Master's degree (1 major) Quantum Technology (2021)

Module title					Abbreviation	
Materia	al Scier	nce 1 (Basic introductio	on)		08-FU-MaWi1-152-n	101
Module	e coord	inator		Module offered by	<u> </u>	
holder thesis	of the (Chair of Chemical Tech	nology of Material Syn-	Chair of Chemical T	echnology of Materi	al Synthesis
ECTS		od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio		Module level	Other prerequisites			
1 seme		undergraduate				
Conten						
Vacuur	m techn	ology, coating process	ering: mixing, commin es, sintering.	ution, agglomeratior	, separation, drying	, conveying.
Intend	ed learı	ning outcomes				
chemic ques a in hanc	cal proc nd can dling of	ess engineering. For a suggest ways of fabrica measurement data as	e knowledge about var given objective they ard ation, processing and t well as statistical and s well as practically dete	e able to weigh the p reatment of material systematic errors an	ros and cons of diffe s. Furthermore they d posess extensive k	erent techni- areconfident knowledge
Course	s (type	, number of weekly con	itact hours, language –	- if other than Germa	n)	
V (3) +	Ü (1)					
			language — if other the can be chosen to earn		tion offered — if not	every seme-
c) oral d) log (e) pres Langua	examin (approx entatio	ation in groups of up to . 20 pages) or n (approx. 30 minutes) ssessment: German ar		-	didate) or	
		Jaces				
Additio	nal inf	ormation				
Worklo	ad					
150 h						
-	ng cycl	e				
Referre	ed to in	LPOI (examination reg	gulations for teaching-	degree programmes)		
Module	e appea	ars in				
Bachel	or's de	gree (1 major) Nanostru	ucture Technology (201	5)		
		gree (1 major) Function				
	-	ee (1 major) Chemistry 1ing degree Gymnasiur	(2016) n MINT Teacher Educat	ion PLUS. Elite Netw	ork Bavaria (FNB) (20	016)
			Education PLUS, Elite			
		ee (1 major) Chemistry				,
			n MINT Teacher Educat Education PLUS, Elite			020)
Bachelor's (2015)	with 1 maj	jor Nanostructure Technology		generated 18-Apr-2025 • exa or (180 ECTS) Nanostrukturte	-	page 30 / 150



Bachelor's degree (1 major) Nanostructure Technology (2020)

Module					Abbreviation	
Materia	al Scier	nce 2 (The Material Gro	oups)		08-FU-MaWi2-152-n	n01
Module	e coord	inator		Module offered by		
holder	of the (hair of Chemical Tech	nology of Material Syn-		echnology of Materia	al Synthesis
thesis	or the v		notogy of material syn		centrology of materia	at oyntheois
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
5		rical grade		• • • •		
Duratio	on	Module level	Other prerequisites			
1 seme		undergraduate				
Conten	ts		I			
and pro loys. Co	operties eramics	s; thermo-mechanical t s: oxidic and non-oxidio	in material groups. Met reatment; Martensitic t c structural ceramics; e noplasts, duromers, ela	ransitions; ductility lectric and magnetic	and strength; form n properties of function	nemory al-
		ning outcomes		· · · · · ·		
		e developed a knowled knowledge to research	ge of the fabrication an problems.	d properties of the n	nain material groups	and are able
	·		itact hours, language –	- if other than Germa	n)	
V (3) +		, <u> </u>			,	
		sessment (type, scope,	language — if other that	an German, examina	tion offered — if not	every seme-
ster, in	formati	on on whether module	can be chosen to earn	a bonus)		
e) pres Langua	entatio	. 20 pages) or n (approx. 30 minutes) ssessment: German ar blaces				
Additio	onal inf	ormation				
			_			
Worklo	ad					
150 h		-				
Teachi	ng cycl	e				
Poforra	d to in	IPOL (examination re	gulations for teaching-o	legree programmes)		
Kelene						
Modula	e appea	ors in				
			ucture Technology (201	-)		
		gree (1 major) Nanostru gree (1 major) Function	•, •	0/		
		ee (1 major) Chemistry	_			
	-		n MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)
			Education PLUS, Elite			
		ee (1 major) Chemistry				
Master	's teacl	ning degree Gymnasiur	n MINT Teacher Educat			020)
		•	Education PLUS, Elite		B) (2020)	
Bachel	or's de	gree (1 major) Nanostru	ucture Technology (202	o)		
Bachelor's	with 1 maj	or Nanostructure Technology	JMU Würzburg •	generated 18-Apr-2025 • exa	am. reg. da-	page 32 / 150

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Bachelor's degree (1 major) Functional Materials (2021) Bachelor's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Bachelor's degree (1 major) Functional Materials (2025)

Module	Module title				Abbreviation	
Molecu	ular Ma	terials (Lecture)			08-FU-MoMaV-152-	m01
Modula	e coord	linator		Module offered by		
			t:			
	e progra Matrier	mme coordinator Funk ials)	tionswerkstoffe (Func-	Chair of Chemical I	echnology of Materi	al Synthesis
ECTS		od of grading	Only after succ. con	n pl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	undergraduate				
Conten	nts					
	cal bon thin filr	ds and molecular interans.	actions, supramolecula	ar chemistry, molecu	lar materials, colloid	ls, nanopar-
Intend	ed lear	ning outcomes				
cal pro teractio	perties ons and elves w	e developed an underst of materials and their d how they determine th ith a topic in the field, o	structure. They know th he properties of molecu	e significance of var ular materials. They h	ious inter and intran nave learned how to	nolecular in- familiarise
Course	es (type	, number of weekly con	itact hours, language –	- if other than Germa	in)	
V (3) +	S (1)					
ster, in [a) writ tes) or 20 pag	iformat tten exa c) oral ges) or e	sessment (type, scope, ion on whether module amination (approx. 90 t examination in groups e) presentation (approx assessment: German ar	can be chosen to earn o 180 minutes) or b) or of up to 3 candidates (. 30 minutes)] as well a	a bonus) al examination of on approx. 15 minutes p	e candidate each (2 ber candidate) or d) l	o to 30 minu- og (approx.
	tion of					
Allocal		places				
 • • • • • • • •						
Αααιτιά		ormation				
Worklo	bad					
150 h	_					
Teachi	ng cycl	е				
Referre	ed to in	LPOI (examination re	gulations for teaching-	degree programmes)		
	-		<u> </u>	<u> </u>		
Module	e appea	ars in				
		gree (1 major) Nanostru	ucture Technology (201	5)		
		gree (1 major) Function				
		ee (1 major) Chemistry				
	-	hing degree Gymnasiur		ion PLUS, Elite Netw	ork Bavaria (ENB) (2	016)
Supple	ementa	ry course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2016)	
1	-	ee (1 major) Chemistry				
		hing degree Gymnasiur				020)
		ry course MINT Teacher			B) (2020)	
1		gree (1 major) Nanostru		0)		
Bachel	ior's de	gree (1 major) Quantun	1 IECNNOLOGY (2021)			
Bachelor's (2015)	with 1 ma	jor Nanostructure Technology		e generated 18-Apr-2025 • exa or (180 ECTS) Nanostrukturte		page 34 / 150



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

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module					Abbreviation	
Chemio	ally an	d bio-inspired Nanoted	hnology for Material S	ynthesis	08-FU-NT-152-mo1	L
Module	coordi	nator		Module offere	d bv	
		mme coordinator Funkt	ionsworkstoffo (Func-		ical Technology of Mate	rial Synthocic
tional N	Aatrieri	als)				
ECTS		od of grading	Only after succ. con	<u>pl. of module(</u>	5)	
5	numer	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
ted ma	terials.				erisation and application f biomaterials, introduct	
Intende	ed learr	ing outcomes				
Studen	ts have	developed a sound kn	owledge of sol-gel che	mistry and bior	nineralisation.	
		number of weekly con				
V (4)	- (., p.,					
Metho					mination offered — if no	ot every seme
		on on whether module		a bonus)		
		nination (approx. 90 to				
		ation of one candidate		•		
		ation in groups of up to	3 candidates (approx	. 15 minutes pe	r candidate) or	
		. 20 pages) or n (approx. 30 minutes)				
		ssessment: German an	d/or English			
Allocat						
Allocal		naces				
Additio	nal info	ormation				
Worklo	ad					
150 h						
Teachi		4				
·caciiii	- <u>5</u> cycll					
)	
Referre	d to in	LPOI (examination reg	guiations for teaching-o	legree program	mes)	
Module	e appea	rs in				
Bachel	or's deg	gree (1 major) Nanostru	cture Technology (201	5)		
Bachel	or's deg	gree (1 major) Function	al Materials (2015)			
Master	's degre	ee (1 major) Chemistry	(2016)			
Master	's teach	ning degree Gymnasiun	n MINT Teacher Educat	ion PLUS, Elite I	Network Bavaria (ENB) (2016)
Supple	mentar	y course MINT Teacher	Education PLUS, Elite	Network Bavaria	a (ENB) (2016)	
Master	's degre	ee (1 major) Chemistry	(2018)			
Master	's teach	ning degree Gymnasiun	n MINT Teacher Educat	ion PLUS, Elite I	Network Bavaria (ENB) (2020)
Supple	mentar	y course MINT Teacher	Education PLUS, Elite	Network Bavaria	a (ENB) (2020)	
Bachel	or's deg	gree (1 major) Nanostru	cture Technology (202	o)		
Bachel	or's deg	gree (1 major) Quantum	Technology (2021)			
Master	's degre	ee (1 major) Chemistry	(2024)			
Sachelor's	with 1 mai	or Nanostructure Technology	IMIT Würzburg	generated 18-Apr-202	e exam reα da.	page 36 / 150



Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module t	itle			Abbreviation
Chemical	Nanotechnology: Analytics a	nd Applications		08-FU-NT-AA-152-m01
Module c	oordinator		Module offered by	<u> </u>
degree programme coordinator Funktionswerkstoffe (Func- tional Matrierials)			Chair of Chemical T	echnology of Material Synthesis
ECTS Method of grading Only after succ. con			npl. of module(s)	
5 n	umerical grade			
Duration	Module level	Other prerequisites		
1 semest	er graduate			
Contents				
	ion to the theory and applicat al methods, dynamic light sca			
Intended	learning outcomes			
Students	have developed an advanced	knowledge of the ch	aracterisation and a	application of nanomaterials.
	type, number of weekly conta			
V (4)				
	of assessment (type, scope, la rmation on whether module ca			ation offered — if not every seme-
d) log (ap e) presen Language	amination in groups of up to g prox. 20 pages) or tation (approx. 30 minutes) of assessment: German and, n of places		. 15 minutes per can	didate) or
Additiona	al information			
 Workload				
150 h				
Teaching	cycle			
	· ·			
Referred	to in LPO I (examination regu	lations for teaching-o	degree programmes)	
Module a	ppears in			
Master's Bachelor Bachelor Master's	s degree (1 major) Nanostruct degree (1 major) Functional M 's degree (1 major) Nanostruct 's degree (1 major) Quantum T degree (1 major) Functional M	aterials (2016) cure Technology (202 echnology (2021) aterials (2022)		
Master's	degree (1 major) Functional M	aterials (2025)		

Module	e title				Abbreviation		
Organi	ic Chem	istry for students of m	edicine, biomedicine, c	lental medicine and	08-0C-NF-152-m01		
natura	l scienc	es					
Module	e coord	inator		Module offered by	<u> </u>		
lecture	er of lect	ure "Organische Chem	ie für Studierende der	Institute of Organic	Chemistry		
	Medizin, Biomedizin, Zahnmedizin, Ingenieur- and Natur-						
	wissenschaften"						
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
3		rical grade		• • • • •			
Duratio	on l	Module level	Other prerequisites				
1 seme		undergraduate					
Conten							
This m	odule p	rovides students with a	an overview of the theo	retical principles of	organic chemistry.		
Intend	ed learr	ning outcomes					
Studen	nts have	become familiar with	the fundamental princi	ples of organic chem	nistry.		
Course	es (type.	number of weekly con	tact hours, language —	if other than Germa	n)		
V (2)		,					
	doface	accmant (tuna ccana	language if other the	n Cormon overning	tion offered if not	overseeme	
			language — if other that can be chosen to earn		tion onered — if not	every seme-	
		nation (approx. 60 min ssessment: German an					
Allocat	tion of p	llaces					
Additio	onal info	ormation					
Worklo	bad						
90 h							
-	ng aval	•					
Teachi	ng cycl	8					
Referre	ed to in	LPOI (examination reg	gulations for teaching-o	legree programmes)			
Module	e appea	rs in					
		gree (1 major) Psycholo	gy (2010)				
		gree (1 major, 1 minor)					
			Political and Social Stu	dies (2013)			
Bachel	lor's de	gree (1 major, 1 minor)	Russian Language and	Culture (2008)			
Bachel	lor's deg	gree (2 majors) Special	Education (2009)				
Magist	er Theo	logiae Catholic Theolog	gy (2013)				
First st	ate exa	mination for the teachi	ng degree Grundschule	English (2009)			
			ng degree Grundschule				
	First state examination for the teaching degree Grundschule Chemistry (2009)						
	First state examination for the teaching degree Grundschule Geography (2009)						
			ng degree Grundschule		y (2009)		
			ng degree Grundschule				
			ng degree Grundschule				
First st			ng degree Grundschule		、 、		
	ato ova	mination for the teachi	ng degree Grundschule	Cathalia Thealamy (2000)		
					-		
First st	ate exa		ng degree Grundschule)	page 39 / 150	

Subdivided Module Catalogue for the Subject Nanostructure Technology Bachelor's with 1 major, 180 ECTS credits

UNIVERSITÄT WÜRZBURG

First state examination for the teaching degree Grundschule Music (2009) First state examination for the teaching degree Grundschule Physics (2009) First state examination for the teaching degree Grundschule Social Science (2009) First state examination for the teaching degree Grundschule Science of Sport (2009) First state examination for the teaching degree Hauptschule English (2009) First state examination for the teaching degree Hauptschule Biology (2009) First state examination for the teaching degree Hauptschule Chemistry (2009) First state examination for the teaching degree Hauptschule Geography (2009) First state examination for the teaching degree Hauptschule Protestant Theology (2009) First state examination for the teaching degree Hauptschule German (2009) First state examination for the teaching degree Hauptschule History (2009) First state examination for the teaching degree Hauptschule Catholic Theology (2009) First state examination for the teaching degree Hauptschule Mathematics (2009) First state examination for the teaching degree Hauptschule Music (2009) First state examination for the teaching degree Hauptschule Physics (2009) First state examination for the teaching degree Hauptschule Social Science (2009) First state examination for the teaching degree Hauptschule Science of Sport (2009) First state examination for the teaching degree Realschule English (2009) First state examination for the teaching degree Realschule Biology (2009) First state examination for the teaching degree Realschule Chemistry (2009) First state examination for the teaching degree Realschule Geography (2009) First state examination for the teaching degree Realschule Protestant Theology (2009) First state examination for the teaching degree Realschule French Studies (2009) First state examination for the teaching degree Realschule German (2009) First state examination for the teaching degree Realschule History (2009) First state examination for the teaching degree Realschule Computer Science (2012) First state examination for the teaching degree Realschule Catholic Theology (2009) First state examination for the teaching degree Realschule Mathematics (2009) First state examination for the teaching degree Realschule Music (2009) First state examination for the teaching degree Realschule Physics (2009) First state examination for the teaching degree Realschule Science of Sport (2009) First state examination for the teaching degree Gymnasium English (2009) First state examination for the teaching degree Gymnasium Biology (2009) First state examination for the teaching degree Gymnasium Chemistry (2009) First state examination for the teaching degree Gymnasium Geography (2009) First state examination for the teaching degree Gymnasium French Studies (2009) First state examination for the teaching degree Gymnasium German (2009) First state examination for the teaching degree Gymnasium History (2009) First state examination for the teaching degree Gymnasium Greek Philology (2009) First state examination for the teaching degree Gymnasium Computer Science (2009) First state examination for the teaching degree Gymnasium Italian Studies (2009) First state examination for the teaching degree Gymnasium Catholic Theology (2009) First state examination for the teaching degree Gymnasium Latin Philology (2009) First state examination for the teaching degree Gymnasium Mathematics (2012) First state examination for the teaching degree Gymnasium Mathematics (2009) First state examination for the teaching degree Gymnasium Music (2009) First state examination for the teaching degree Gymnasium Physics (2009) First state examination for the teaching degree Gymnasium Russian (2009) First state examination for the teaching degree Gymnasium Social Science (2009) First state examination for the teaching degree Gymnasium Spanish Studies (2009) First state examination for the teaching degree Gymnasium Science of Sport (2009) First state examination for the teaching degree Gymnasium Music Education, Advanced Studies (2009) First state examination for the teaching degree Sonderpädagogik Pedagogy of Secondary Education (2009) Bachelor's with 1 major Nanostructure Technology IMU Würzburg • generated 18-Apr-2025 • exam. reg. dapage 40 / 150 (2015) ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015

First state examination for the teaching degree Sonderpädagogik Pedagogy of Primary Education (2009) First state examination for the teaching degree Sonderpädagogik Teaching at the German Mittelschule (2013) First state examination for the teaching degree Mittelschule English (2013) First state examination for the teaching degree Mittelschule Biology (2013) First state examination for the teaching degree Mittelschule Chemistry (2013) First state examination for the teaching degree Mittelschule Geography (2013) First state examination for the teaching degree Mittelschule Protestant Theology (2013) First state examination for the teaching degree Mittelschule German (2013) First state examination for the teaching degree Mittelschule History (2013) First state examination for the teaching degree Mittelschule Catholic Theology (2013) First state examination for the teaching degree Mittelschule Mathematics (2013) First state examination for the teaching degree Mittelschule Physics (2013) First state examination for the teaching degree Mittelschule Social Science (2013) First state examination for the teaching degree Mittelschule Science of Sport (2013) Bachelor's degree (2 majors) English and American Studies (2009) Bachelor's degree (2 majors) German Language and Literature (2013) Bachelor's degree (1 major) Geography (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Musicology (2015) Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Psychology (2015) Bachelor's degree (1 major) Business Management and Economics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Music Education (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Political and Social Studies (2015) Bachelor's degree (1 major) Academic Speech Therapy (2015) Bachelor's degree (1 major) Indology/South Asian Studies (2015) Bachelor's degree (1 major, 1 minor) Egyptology (2015) Bachelor's degree (1 major, 1 minor) Pedagogy (2015) Bachelor's degree (1 major, 1 minor) History (2015) Bachelor's degree (1 major, 1 minor) Musicology (2015) Bachelor's degree (1 major, 1 minor) Philosophy (2015) Bachelor's degree (1 major, 1 minor) Pre- and Protohistoric Archaeology (2015) Bachelor's degree (1 major, 1 minor) Ancient World (2015) Bachelor's degree (1 major, 1 minor) Philosophy and Religion (2015) Bachelor's degree (1 major, 1 minor) Theological Studies (2015) Bachelor's degree (1 major, 1 minor) Political and Social Studies (2015) Bachelor's degree (1 major, 1 minor) Russian Language and Culture (2015) Bachelor's degree (1 major, 1 minor) German Language and Literature (2015) Bachelor's degree (2 majors) Egyptology (2015) Bachelor's degree (2 majors) Pedagogy (2015) Bachelor's degree (2 majors) Protestant Theology (2015) Bachelor's degree (2 majors) Musicology (2015) Bachelor's degree (2 majors) Philosophy (2015) Bachelor's degree (2 majors) Special Education (2015) Bachelor's degree (2 majors) Pre- and Protohistoric Archaeology (2015) Bachelor's degree (2 majors) Latin Philology (2015) Bachelor's degree (2 majors) Music Education (2015) Bachelor's degree (2 majors) Philosophy and Religion (2015) Bachelor's degree (2 majors) Theological Studies (2015) Bachelor's degree (2 majors) Political and Social Studies (2015) Bachelor's degree (2 majors) Russian Language and Culture (2015) Bachelor's with 1 major Nanostructure Technology JMU Würzburg • generated 18-Apr-2025 • exam. reg. dapage 41 / 150 (2015) ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015

(2015)

Bachelor's degree (2 majors) Greek Philology (2015) Bachelor's degree (2 majors) European Ethnology (2015) Bachelor's degree (2 majors) Indology/South Asian Studies (2015) First state examination for the teaching degree Grundschule English (2015) First state examination for the teaching degree Grundschule Biology (2015) First state examination for the teaching degree Grundschule Chemistry (2015) First state examination for the teaching degree Grundschule Geography (2015) First state examination for the teaching degree Grundschule German (2015) First state examination for the teaching degree Grundschule Catholic Theology (2015) First state examination for the teaching degree Grundschule Mathematics (2015) First state examination for the teaching degree Grundschule Pedagogy of Primary Education (2015) First state examination for the teaching degree Grundschule Physics (2015) First state examination for the teaching degree Grundschule Social Science (2015) First state examination for the teaching degree Grundschule Didactics in English (Primary School) (2015) First state examination for the teaching degree Grundschule Didactics in Biology (Primary School) (2015) First state examination for the teaching degree Grundschule Didactics in Chemistry (Primary School) (2015) First state examination for the teaching degree Grundschule Didactics in Geography (Primary School) (2015) First state examination for the teaching degree Grundschule Didactics in German (Primary School) (2015) First state examination for the teaching degree Grundschule Didactics in History (Primary School) (2015) First state examination for the teaching degree Grundschule Didactics in Catholic Theology (Primary School) (2015) First state examination for the teaching degree Grundschule Art Education in Primary School (2015) First state examination for the teaching degree Grundschule Didactics in Science of Sport (Primary School) (2015) First state examination for the teaching degree Grundschule Didactics in Mathematics (Primary School) (2015) First state examination for the teaching degree Grundschule Music Education in Primary School (2015) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2015) First state examination for the teaching degree Grundschule Didactics in Social Science (Primary School) (2015) First state examination for the teaching degree Grundschule Science of Sport (2015) First state examination for the teaching degree Realschule English (2015) First state examination for the teaching degree Realschule Biology (2015) First state examination for the teaching degree Realschule Chemistry (2015) First state examination for the teaching degree Realschule Geography (2015) First state examination for the teaching degree Realschule Protestant Theology (2015) First state examination for the teaching degree Realschule French Studies (2015) First state examination for the teaching degree Realschule German (2015) First state examination for the teaching degree Realschule History (2015) First state examination for the teaching degree Realschule Computer Science (2015) First state examination for the teaching degree Realschule Catholic Theology (2015) First state examination for the teaching degree Realschule Mathematics (2015) First state examination for the teaching degree Realschule Physics (2015) First state examination for the teaching degree Realschule Science of Sport (2015) First state examination for the teaching degree Gymnasium English (2015) First state examination for the teaching degree Gymnasium Biology (2015) First state examination for the teaching degree Gymnasium Chemistry (2015) First state examination for the teaching degree Gymnasium Geography (2015) First state examination for the teaching degree Gymnasium French Studies (2015) First state examination for the teaching degree Gymnasium German (2015) First state examination for the teaching degree Gymnasium History (2015) First state examination for the teaching degree Gymnasium Greek Philology (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) First state examination for the teaching degree Gymnasium Italian Studies (2015) First state examination for the teaching degree Gymnasium Catholic Theology (2015) First state examination for the teaching degree Gymnasium Latin Philology (2015) Bachelor's with 1 major Nanostructure Technology JMU Würzburg • generated 18-Apr-2025 • exam. reg. dapage 42 / 150

ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015

Subdivided Module Catalogue for the Subject Nanostructure Technology Bachelor's with 1 major, 180 ECTS credits

First state examination for the teaching degree Gymnasium Mathematics (2015) First state examination for the teaching degree Gymnasium Physics (2015) First state examination for the teaching degree Gymnasium Russian (2015) First state examination for the teaching degree Gymnasium Social Science (2015) First state examination for the teaching degree Gymnasium Spanish Studies (2015) First state examination for the teaching degree Gymnasium Science of Sport (2015) First state examination for the teaching degree Sonderpädagogik Pedagogy of Primary Education (2015) First state examination for the teaching degree Sonderpädagogik Didactics in German (Primary School) (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Catholic Theology (Primary School) (2015) First state examination for the teaching degree Sonderpädagogik Art Education in Primary School (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Science of Sport (Primary School) (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Mathematics (Primary School) (2015) First state examination for the teaching degree Sonderpädagogik Music Education in Primary School (2015) First state examination for the teaching degree Sonderpädagogik Didactics in English (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Ergonomics (Teaching at the German Mittelschule) (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Biology (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Chemistry (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Geography (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Protestant Theology (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Didactics in German (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Didactics in History (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Catholic Theology (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Art Education in Middle School (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Science of Sport (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Mathematics (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Music Education in Middle School (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Social Science (Middle School) (2015) First state examination for the teaching degree Sonderpädagogik Teaching at the German Mittelschule (2015) First state examination for the teaching degree Mittelschule English (2015) First state examination for the teaching degree Mittelschule Biology (2015) First state examination for the teaching degree Mittelschule Chemistry (2015) First state examination for the teaching degree Mittelschule Geography (2015) First state examination for the teaching degree Mittelschule Protestant Theology (2015) First state examination for the teaching degree Mittelschule German (2015) First state examination for the teaching degree Mittelschule History (2015) First state examination for the teaching degree Mittelschule Catholic Theology (2015) First state examination for the teaching degree Mittelschule Mathematics (2015) First state examination for the teaching degree Mittelschule Physics (2015) First state examination for the teaching degree Mittelschule Social Science (2015) First state examination for the teaching degree Mittelschule Didactics in English (Middle School) (2015) First state examination for the teaching degree Mittelschule Ergonomics (Teaching at the German Mittelschule) (2015) First state examination for the teaching degree Mittelschule Didactics in Biology (Middle School) (2015)

Bachelor's with 1 major Nanostructure Technology	JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-	page 43 / 150
(2015)	ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015	

First state examination for the teaching degree Mittelschule Didactics in Chemistry (Middle School) (2015) First state examination for the teaching degree Mittelschule Didactics in Geography (Middle School) (2015) First state examination for the teaching degree Mittelschule Didactics in Protestant Theology (Middle School) (2015)

First state examination for the teaching degree Mittelschule Didactics in German (Middle School) (2015) First state examination for the teaching degree Mittelschule Didactics in History (Middle School) (2015) First state examination for the teaching degree Mittelschule Didactics in Catholic Theology (Middle School) (2015)

First state examination for the teaching degree Mittelschule Art Education in Middle School (2015) First state examination for the teaching degree Mittelschule Didactics in Science of Sport (Middle School) (2015) First state examination for the teaching degree Mittelschule Didactics in Mathematics (Middle School) (2015) First state examination for the teaching degree Mittelschule Music Education in Middle School (2015) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2015) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2015) First state examination for the teaching degree Mittelschule Didactics in Social Science (Middle School) (2015) First state examination for the teaching degree Mittelschule Science of Sport (2015)

First state examination for the teaching degree Mittelschule Teaching at the German Mittelschule (2015) Bachelor's degree (2 majors) Geography (2015)

Bachelor's degree (2 majors) French Studies (2015)

Bachelor's degree (2 majors) History (2015)

Bachelor's degree (2 majors) Sport Science (Focus on health and Pedagogics in Movement) (2015)

Bachelor's degree (2 majors) German Language and Literature (2015)

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

First state examination for the teaching degree Grundschule Protestant Theology (2015)

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

First state examination for the teaching degree Grundschule Didactics in Protestant Theology (Primary School) (2015)

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

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

First state examination for the teaching degree Gymnasium Music Education, Advanced Studies (2015)

First state examination for the teaching degree Sonderpädagogik Didactics in Protestant Theology (Primary School) (2015)

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

Bachelor's degree (1 major, 1 minor) French Studies (2016)

Bachelor's degree (2 majors) French Studies (2016)

Bachelor's degree (1 major, 1 minor) Italian Studies (2016)

Bachelor's degree (2 majors) Italian Studies (2016)

Bachelor's degree (1 major, 1 minor) Spanish Studies (2016)

Bachelor's degree (2 majors) Spanish Studies (2016)

Bachelor's degree (1 major) Romanic Languages (French/Italian) (2016)

Bachelor's degree (1 major) Romanic Languages (French/Spanish) (2016)

Bachelor's degree (1 major) Romanic Languages (Italian/Spanish) (2016)

Bachelor's degree (1 major) Business Information Systems (2016)

First state examination for the teaching degree Gymnasium French Studies (2016)

First state examination for the teaching degree Gymnasium Italian Studies (2016)

First state examination for the teaching degree Gymnasium Spanish Studies (2016)

First state examination for the teaching degree Realschule French Studies (2016)

Bachelor's degree (1 major) Games Engineering (2016)

Bachelor's degree (1 major, 1 minor) English and American Studies (2016)

Bachelor's degree (2 majors) English and American Studies (2016)

First state examination for the teaching degree Grundschule English (2016)

First state examination for the teaching degree Grundschule Didactics in English (Primary School) (2016)

First state examination for the teaching degree Realschule English (2016)

First state examination for the teaching degree Gymnasium English (2016)

Bachelor's with 1 major Nanostructure Technology	JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-	page 44 / 150
(2015)	ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015	

First state examination for the teaching degree Mittelschule English (2016) First state examination for the teaching degree Mittelschule Didactics in English (Middle School) (2016) First state examination for the teaching degree Sonderpädagogik Didactics in English (Middle School) (2016) Bachelor's degree (1 major) Media Communication (2016) Bachelor's degree (1 major, 1 minor) Digital Humanities (2016) Bachelor's degree (1 major, 1 minor) Geography (2017) Bachelor's degree (1 major, 1 minor) History of Medieval and Modern Art (2017) Bachelor's degree (2 majors) History of Medieval and Modern Art (2017) Bachelor's degree (2 majors) Comparative Indo-European Linguistics (2017) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major, 1 minor) Museology and material culture (2017) Bachelor's degree (1 major) Economathematics (2017) Bachelor's degree (1 major) Games Engineering (2017) Bachelor's degree (1 major) Computer Science (2017) First state examination for the teaching degree Gymnasium Greek Philology (2018) Bachelor's degree (1 major) Media Communication (2018) Bachelor's degree (1 major) Biomedicine (2018) Bachelor's degree (1 major) Human-Computer Systems (2018) Bachelor's degree (2 majors) Classical Archaeology (2018) Bachelor's degree (1 major, 1 minor) Classical Archaeology (2018) Bachelor's degree (1 major, 1 minor) Digital Humanities (2018) Bachelor's degree (2 majors) Digital Humanities (2018) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2018) First state examination for the teaching degree Realschule Physics (2018) First state examination for the teaching degree Gymnasium Physics (2018) First state examination for the teaching degree Mittelschule Physics (2018) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2018) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2018) Bachelor's degree (1 major) Computer Science (2019) First state examination for the teaching degree Gymnasium Mathematics (2019) Bachelor's degree (1 major, 1 minor) English and American Studies (2019) Module studies (Bachelor) Chemistry (2019) Bachelor's degree (1 major) Indology/South Asian Studies (2019) Bachelor's degree (1 major) Business Information Systems (2019) Bachelor's degree (2 majors) Indology/South Asian Studies (2019) Bachelor's degree (1 major) Business Management and Economics (2019) Bachelor's degree (1 major) Modern China (2019) Module studies (Bachelor) Orientierungsstudien (2020) Bachelor's degree (1 major) Biomedicine (2020) Bachelor's degree (1 major) Pedagogy (2020) Bachelor's degree (1 major) Political and Social Studies (2020) Bachelor's degree (1 major) Business Information Systems (2020) Bachelor's degree (1 major, 1 minor) Political and Social Studies (2020) Bachelor's degree (2 majors) European Ethnology (2020) Bachelor's degree (2 majors) Political and Social Studies (2020) Bachelor's degree (2 majors) Special Education (2020) First state examination for the teaching degree Mittelschule Biology (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Sonderpädagogik Didactics in Biology (Middle School) (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Mittelschule Didactics in Biology (Middle School) (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Mittelschule Chemistry (2020 (Prüfungsordnungsversion 2015))

Bachelor's with 1 major Nanostructure Technology	JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-	page 45 / 150
(2015)	ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015	

First state examination for the teaching degree Mittelschule Didactics in Chemistry (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Mittelschule German (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Mittelschule Didactics in German (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Mittelschule English (2020 (Prüfungsordnungsversion 2016)) First state examination for the teaching degree Mittelschule Didactics in English (Middle School) (2020 (Prüfungsordnungsversion 2016))

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

First state examination for the teaching degree Mittelschule Didactics in Protestant Theology (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Mittelschule Geography (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Mittelschule Didactics in Geography (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Mittelschule History (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Mittelschule Didactics in History (Middle School) (2020 (Prüfungsordnungsversion 2015))

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

First state examination for the teaching degree Mittelschule Didactics in Catholic Theology (Middle School) (2020 (Prüfungsordnungsversion 2015))

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

First state examination for the teaching degree Mittelschule Didactics in Mathematics (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Mittelschule Art Education in Middle School (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Mittelschule Science of Sport (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Mittelschule Didactics in Science of Sport (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Mittelschule Music (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Mittelschule Music Education in Middle School (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Mittelschule Teaching at the German Mittelschule (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Sonderpädagogik Didactics in English (Middle School) (2020 (Prüfungsordnungsversion 2016))

First state examination for the teaching degree Sonderpädagogik Didactics in Chemistry (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Sonderpädagogik Didactics in Geography (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Sonderpädagogik Didactics in Protestant Theology (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Sonderpädagogik Didactics in German (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Sonderpädagogik Didactics in History (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Sonderpädagogik Didactics in Catholic Theology (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Sonderpädagogik Art Education in Middle School (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Sonderpädagogik Didactics in Science of Sport (Middle School) (2020 (Prüfungsordnungsversion 2015))

Bachelor's with 1 major Nanostructure Technology	JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-	page 46 / 150
(2015)	ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015	

(2015)

First state examination for the teaching degree Sonderpädagogik Didactics in Mathematics (Middle School) (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Sonderpädagogik Music Education in Middle School (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Sonderpädagogik Teaching at the German Mittelschule (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Sonderpädagogik Art Education in Primary School (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Sonderpädagogik Music Education in Primary School (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Sonderpädagogik Didactics in Science of Sport (Primary School) (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Sonderpädagogik Didactics in German (Primary School) (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Sonderpädagogik Didactics in Mathematics (Primary School) (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Sonderpädagogik Pedagogy of Primary Education (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Sonderpädagogik Didactics in Protestant Theology (Primary School) (2020 (Prüfungsordnungsversion 2015)) First state examination for the teaching degree Sonderpädagogik Didactics in Catholic Theology (Primary School) (2020 (Prüfungsordnungsversion 2015)) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major, 1 minor) Museology and material culture (2020) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2020) First state examination for the teaching degree Grundschule Physics (2020) First state examination for the teaching degree Gymnasium Physics (2020) First state examination for the teaching degree Realschule Physics (2020) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Physics (2020) Bachelor's degree (1 major, 1 minor) Pedagogy (2020) Bachelor's degree (2 majors) Pedagogy (2020) First state examination for the teaching degree Grundschule Political and Social Studies (2020) First state examination for the teaching degree Grundschule Didactics in Political and Social Studies (Primary School) (2020) First state examination for the teaching degree Sonderpädagogik MS-Didaktik Career and Economics (2020) First state examination for the teaching degree Sonderpädagogik Didactics in Political and Social Studies (Secondary School) (2020) First state examination for the teaching degree Mittelschule MS-Didaktik Career and Economics (2020) First state examination for the teaching degree Mittelschule Didactics in Political and Social Studies (Secondary School) (2020) First state examination for the teaching degree Mittelschule Political and Social Studies (2020) First state examination for the teaching degree Gymnasium Political and Social Studies (2020) Bachelor's degree (1 major) Psychology (2020) Magister Theologiae Catholic Theology (2021) Bachelor's degree (2 majors) History (2021) Bachelor's degree (1 major, 1 minor) History (2021) First state examination for the teaching degree Grundschule History (2021) First state examination for the teaching degree Gymnasium History (2021) First state examination for the teaching degree Realschule History (2021) IMU Würzburg • generated 18-Apr-2025 • exam. reg. da-Bachelor's with 1 major Nanostructure Technology page 47 / 150

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First state examination for the teaching degree Mittelschule History (2021) Bachelor's degree (1 major) Media Communication (2021) Bachelor's degree (2 majors) Theological Studies (2021) Bachelor's degree (1 major, 1 minor) Theological Studies (2021) Bachelor's degree (1 major, 1 minor) English and American Studies (2021) Bachelor's degree (2 majors) English and American Studies (2021) First state examination for the teaching degree Grundschule Pedagogy of Primary Education (2021) First state examination for the teaching degree Gymnasium English (2021) First state examination for the teaching degree Gymnasium Philosophy and Ethics (2021) Bachelor's degree (1 major) Computer Science und Sustainability (2021) Bachelor's degree (2 majors) Comparative Indo-European Linguistics (2021) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (2 majors) Special Education (2021) Bachelor's degree (1 major) Business Information Systems (2021) Bachelor's degree (1 major) Economathematics (2021) Bachelor's degree (1 major) Business Management and Economics (2021) First state examination for the teaching degree Sonderpädagogik Pedagogy of Primary Education (2021) Bachelor's degree (1 major) Human-Computer Systems (2022) Bachelor's degree (1 major, 1 minor) Museology and material culture (2022) Bachelor's degree (1 major) Economathematics (2022) Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) First state examination for the teaching degree Gymnasium Philosophy and Ethics (2022) Bachelor's degree (2 majors) Ancient Near Eastern Archaeology (2022) Bachelor's degree (1 major, 1 minor) Ancient World (2022) Bachelor's degree (2 majors) Ancient Near Eastern Studies (2022) Bachelor's degree (1 major) Franco-German studies: language, culture, digital competence (2022) First state examination for the teaching degree Gymnasium Russian (2023) First state examination for the teaching degree Gymnasium Mathematics (2023) First state examination for the teaching degree Gymnasium English (2023) First state examination for the teaching degree Realschule English (2023) First state examination for the teaching degree Grundschule English (2023) First state examination for the teaching degree Grundschule Didactics in English (Primary School) (2023) First state examination for the teaching degree Mittelschule English (2023) First state examination for the teaching degree Mittelschule Didactics in English (Middle School) (2023) First state examination for the teaching degree Sonderpädagogik Didactics in English (Middle School) (2023) First state examination for the teaching degree Gymnasium Geography (2023) First state examination for the teaching degree Realschule Geography (2023) First state examination for the teaching degree Grundschule Geography (2023) First state examination for the teaching degree Mittelschule Geography (2023) Bachelor's degree (1 major) European Law (2023) Bachelor's degree (1 major, 1 minor) English and American Studies (2023) Bachelor's degree (2 majors) English and American Studies (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Business Information Systems (2023) Bachelor's degree (1 major) Economathematics (2023) Bachelor's degree (1 major, 1 minor) History of Medieval and Modern Art (2023) Bachelor's degree (2 majors) History of Medieval and Modern Art (2023) Bachelor's degree (2 majors) Special Education (2023) Bachelor's degree (1 major) Business Management and Economics (2023) Bachelor's degree (1 major) Geography (2023) Bachelor's degree (2 majors) Geography (2023) Bachelor's with 1 major Nanostructure Technology JMU Würzburg • generated 18-Apr-2025 • exam. reg. dapage 48 / 150 (2015) ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015

Subdivided Module Catalogue for the Subject Nanostructure Technology Bachelor's with 1 major, 180 ECTS credits

Bachelor's degree (1 major, 1 minor) Geography (2023) Bachelor's degree (2 majors) European Ethnology/Empiric Cultural Studies (2023) First state examination for the teaching degree Grundschule German (2024) First state examination for the teaching degree Gymnasium German (2024) First state examination for the teaching degree Realschule German (2024) First state examination for the teaching degree Sonderpädagogik Didactics in German (Middle School) (2024) First state examination for the teaching degree Mittelschule Didactics in German (Middle School) (2024) First state examination for the teaching degree Grundschule Didactics in German (Primary School) (2024) First state examination for the teaching degree Sonderpädagogik Didactics in German (Primary School) (2024) First state examination for the teaching degree Mittelschule German (2024) Bachelor's degree (1 major) Mathematical Physics (2024) Bachelor's degree (2 majors) German Language and Literature (2024) Bachelor's degree (1 major, 1 minor) German Language and Literature (2024) Bachelor's degree (1 major) Music Education (2024) Bachelor's degree (2 majors) Music Education (2024) Bachelor's degree (1 major, 1 minor) Music Education (2024) First state examination for the teaching degree Grundschule Music Education in Primary School (2024) First state examination for the teaching degree Sonderpädagogik Music Education in Primary School (2024) First state examination for the teaching degree Mittelschule Music Education in Middle School (2024) First state examination for the teaching degree Sonderpädagogik Music Education in Middle School (2024) Bachelor's degree (1 major) Indology/South Asian Studies (2024) Bachelor's degree (2 majors) Indology/South Asian Studies (2024) Bachelor's degree (1 major, 1 minor) Indology/South Asian Studies (2024) Bachelor's degree (1 major, 1 minor) Ancient World (2024) Bachelor's degree (2 majors) Digital Humanities (2024) Bachelor's degree (1 major, 1 minor) Digital Humanities (2024) Bachelor's degree (1 major) Midwifery (2024) Bachelor's degree (2 majors) Greek Philology (2024) Bachelor's degree (2 majors) Latin Philology (2024) First state examination for the teaching degree Gymnasium Latin Philology (2024) Bachelor's degree (1 major) Business Information Systems (2024) Bachelor's degree (1 major) Economathematics (2024) Bachelor's degree (1 major) Business Management and Economics (2024) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024) First state examination for the teaching degree Gymnasium English (2024) First state examination for the teaching degree Mittelschule MS-Didaktik Career and Economics (2024) First state examination for the teaching degree Sonderpädagogik MS-Didaktik Career and Economics (2024) First state examination for the teaching degree Grundschule History (2024) First state examination for the teaching degree Gymnasium History (2024) First state examination for the teaching degree Realschule History (2024) First state examination for the teaching degree Mittelschule History (2024) First state examination for the teaching degree Mittelschule Didactics in History (Middle School) (2024) First state examination for the teaching degree Sonderpädagogik Didactics in History (Middle School) (2024) First state examination for the teaching degree Grundschule Didactics in History (Primary School) (2024) First state examination for the teaching degree Gymnasium Greek Philology (2024) Bachelor's degree (1 major) Human-Computer-Interaction (2024) First state examination for the teaching degree Grundschule Art Education in Primary School (2024) First state examination for the teaching degree Sonderpädagogik Art Education in Primary School (2024) First state examination for the teaching degree Sonderpädagogik Art Education in Middle School (2024) First state examination for the teaching degree Mittelschule Art Education in Middle School (2024) Bachelor's degree (2 majors) Art Education (2024) Bachelor's degree (1 major) Digital Business & Data Science (2024) Bachelor's degree (1 major) Classics (2024) Bachelor's with 1 major Nanostructure Technology JMU Würzburg • generated 18-Apr-2025 • exam. reg. dapage 49 / 150 (2015) ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015



Bachelor's degree (1 major) Diversity, Ethics and Religions (2024) Bachelor's degree (1 major) (2025) Bachelor's degree (1 major, 1 minor) European Ethnology/Empiric Cultural Studies (2025) Bachelor's degree (1 major) Pedagogy (2025) Bachelor's degree (2 majors) Pedagogy (2025) Bachelor's degree (1 major) Economathematics (2025) Bachelor's degree (1 major) Academic Speech Therapy (2025) Bachelor's degree (1 major, 1 minor) Pedagogy (2025) Bachelor's degree (1 major, 1 minor) Pedagogy (2025) Bachelor's degree (1 major, 1 minor) Pedagogy (2025)

Modul	e title				Abbreviation
Nanos	cale Ma	iterials			08-PCM3-152-m01
Modul	e coord	inator		Module offered by	
lecturer of the seminar "Nanoskalige Materialien"			aterialien"		l and Theoretical Chemistry
ECTS					
5	numerical grade		• • • •		
Durati	on	Module level	Other prerequisites		
1 seme	ester	graduate			
Conter	nts				
		liscusses advanced topic naracterisation methods a			e structure, properties, fabricati- rials.
Intend	ed lear	ning outcomes	,		
		able to characterise nano moscale materials.	scale materials. They	are able to name ar	nalytical methods and applicati-
Course	es (type	, number of weekly conta	ct hours, language –	- if other than Germa	in)
S (2) +	Ü (1)				
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-
(appro Langua	x. 30 m	inutes) ssessment: German and,		on of one candidate	each (approx. 20 minutes) or talk
Alloca	tion of _l	places			
Additi	onal inf	ormation			
Workle	oad				
150 h					
-	Teaching cycle				
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Modul	e appea	ars in			
Bache	lor's de	gree (1 major) Nanostruct gree (1 major) Nanostruct			

Module title					Abbreviation		
Compu	Computational Mathematics 10-M-COM-152-mo1						
Module coordinator				Module offered by			
			atian)				
ECTS		es Mathematik (Mathema	r [′]	Institute of Mathematics			
Duration Module level Other prerequisites 1 semester undergraduate							
Contents							
Introdu merica	Introduction to modern mathematical software for symbolic computation (e.g. Mathematica or Maple) and nu- merical computation (e.g. Matlab) to supplement the basic modules in analysis and linear algebra (10-M-ANA-G and 10-M-LNA-G). Computer-based solution of problems in linear algebra, geometry, analysis, in particular diffe-						
		egral calculus; visualisat		illieal algebia, geolli	etty, anatysis, in par		
Intend	ed learı	ning outcomes					
		arns the use of advance cation to solve mathema		cal software package	es, and is able to ass	sess their	
Course	es (type	, number of weekly conta	act hours, language –	- if other than Germa	n)		
V (1) +	Ü (2)						
		s essment (type, scope, la on on whether module c			tion offered — if not	every seme-	
Langua	age of a	form of programming exe ssessment: German and ffered: Once a year, wint	/or English	25 hours)			
Allocat	tion of p	olaces					
Additio	onal inf	ormation					
	-						
Worklo	bad						
120 h							
Teachi	ng cycl	e					
Referre	ed to in	LPOI (examination regu	lations for teaching-	legree programmes)			
§ 22	Nr. 3 f)						
	e appea	urs in					
		gree (1 major) Mathemat	ics (2015)				
		gree (1 major) Physics (2)					
		gree (1 major) Nanostruc		5)			
		gree (1 major) Economati	•, .				
	Bachelor's degree (1 major) Mathematical Physics (2015)						
Bachelor's degree (1 major) Computational Mathematics (2015)							
Bachelor's degree (1 major) Functional Materials (2015)							
		mination for the teaching		Mathematics (2015)			
		gree (1 major) Mathemat					
		gree (1 major) Economatl	•				
		mination for the teaching		Mathematics (2019)			
		gree (1 major) Physics (2					
		gree (1 major) Nanostruc		o)			
Bachelor's (2015)	with 1 maj	or Nanostructure Technology	-	generated 18-Apr-2025 • exa or (180 ECTS) Nanostrukturte	-	page 52 / 150	

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

Modu	le title				Abbreviation	
Nume	rical Ma	thematics 1 for student	s of other subjects		10-M-NUM1af-152-1	m01
Modul	le coord	inator		Module offered by		
Dean of Studies Mathematik (Mathematics)			natics)	Institute of Mathematics		
			1			
ECTS Method of grading Only after succ. compl. of module(s) 10 numerical grade						
Durati		Module level	Other prerequisites			
1 seme		undergraduate				
		undergraduate				
Conte						<u> </u>
		stems of linear equation tion with polynomials, s				s of equati-
		ning outcomes	<u> </u>			
		acquainted with the fu	ndamontal conconte a	nd mothods in num	prical mathematics	applies them
		oblems and knows abo				applies then
		, number of weekly cont		• •	n)	
		number of weekly con	act nours, tanguage –	n other than Germa	11 <i>)</i>	
V (4) +						
		essment (type, scope, on on whether module			tion offered — if not	every seme-
		nination (approx. 90 to		•		
		ation of one candidate				
		ation in groups (groups				
		ssessment: German and	d/or English			
credita	able for	bonus				
Alloca	tion of p	olaces				
Additi	onal info	ormation				
Workl	oad					
300 h						
-		-				
Teach	ing cycl	2				
Referr	ed to in	LPOI (examination reg	ulations for teaching-o	legree programmes)		
Modul	le appea	rs in				
Bache	lor's de	gree (1 major) Computer	r Science (2015)			
Bache	lor's deg	gree (1 major) Physics (2	2015)			
		gree (1 major) Nanostru				
Bachelor's degree (1 major) Aerospace Computer Science (2015)						
Bachelor's degree (1 major) Functional Materials (2015)						
Bachelor's degree (1 major) Aerospace Computer Science (2017)						
Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019)						
		gree (1 major) Computer gree (1 major) Physics (2	-			
		gree (1 major) Physics (2 gree (1 major) Nanostru		0)		
		gree (1 major) Aerospac				
		gree (1 major) Functiona		· · - /		
			r Science und Sustaina	ability (2021)		
Bache		J (=		()		
		or Nanostructure Technology		generated 18-Apr-2025 • exa	am reg da-	page 54 / 150

Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024) Bachelor's degree (1 major) Functional Materials (2025)

mouut	e title					Abbreviation
Numer	ical Mat	hematics 2 for stud	ents of other	subjects		10-M-NUM2af-152-m01
Modul	e coordi	nator			Module offered by	
Dean of Studies Mathematik (Mathematics)				Institute of Mathematics		
ECTS Method of grading Only after su			tor succ co			
10		ical grade			mpt. of modul	5(5)
Duratio	· · · · ·		Othorm	vovoquicito	-	
1 seme		Module level undergraduate	Other p	orerequisite	5	
	!	undergraduate				
Conter						
		blems, linear progra e problems.	amming, met	hods for ini	tial value prob	lems for ordinary differential equatio
Intend	ed learn	ing outcomes				
about	their adv		tions concerr			of numerical mathematics and knows plication in different fields of natural
Course	es (type,	number of weekly c	ontact hours	, language	— if other thar	German)
V (4) +	Ü (2)					
Metho	d of ass	essment (type, scor	e, language	— if other th	nan German, e	kamination offered — if not every sem
		on on whether modu				,
c) oral	examina examina	nination (approx. 90 ation of one candida ation in groups (grou ssessment: German	ate each (15 t ups of 2, 10 t	o 30 minute 0 15 minute	es) or	e)
c) oral Langua credita	examina examina age of as able for b	ation of one candida ation in groups (grou ssessment: German bonus	ate each (15 t ups of 2, 10 t	o 30 minute 0 15 minute	es) or	e)
c) oral Langua credita	examina examina age of as	ation of one candida ation in groups (grou ssessment: German bonus	ate each (15 t ups of 2, 10 t	o 30 minute 0 15 minute	es) or	e)
c) oral Langua credita Allocat	examina examina age of as able for b tion of p	ation of one candida ation in groups (grou ssessment: German bonus laces	ate each (15 t ups of 2, 10 t	o 30 minute 0 15 minute	es) or	e)
c) oral Langua credita Allocat	examina examina age of as able for b tion of p	ation of one candida ation in groups (grou ssessment: German bonus	ate each (15 t ups of 2, 10 t	o 30 minute 0 15 minute	es) or	e)
c) oral Langua credita Allocat Additic	examina examina age of as ble for b tion of p onal info	ation of one candida ation in groups (grou ssessment: German bonus laces	ate each (15 t ups of 2, 10 t	o 30 minute 0 15 minute	es) or	e)
c) oral Langua credita Allocat Additio Worklo	examina examina age of as ble for b tion of p onal info	ation of one candida ation in groups (grou ssessment: German bonus laces	ate each (15 t ups of 2, 10 t	o 30 minute 0 15 minute	es) or	e)
c) oral Langua credita Allocat Additio Worklo 300 h	examina examina age of as ble for b tion of p onal info	ation of one candida ation in groups (grou ssessment: German bonus laces	ate each (15 t ups of 2, 10 t	o 30 minute 0 15 minute	es) or	e)
c) oral Langua credita Allocat Additio Worklo 300 h	examina examina age of as ble for b tion of p onal info	ation of one candida ation in groups (grou ssessment: German bonus laces	ate each (15 t ups of 2, 10 t	o 30 minute 0 15 minute	es) or	e)
c) oral Langua credita Allocat Additio Worklo 300 h Teachi	examina examina age of as ble for b tion of p onal info	ation of one candida ation in groups (grou ssessment: German bonus laces	ate each (15 t ups of 2, 10 t and/or Engli	to 30 minute o 15 minute sh	es) or s per candidat	
c) oral Langua credita Allocat Additio Worklo 300 h Teachi	examina examina age of as ble for b tion of p onal info	ation of one candida ation in groups (grou ssessment: German bonus laces	ate each (15 t ups of 2, 10 t and/or Engli	to 30 minute o 15 minute sh	es) or s per candidat	
c) oral Langua credita Allocat Additio Worklo 300 h Teachi Referro	examina examina age of as ble for b tion of p onal info oad ng cycle	ation of one candida ation in groups (grou seessment: German bonus laces mmation	ate each (15 t ups of 2, 10 t and/or Engli	to 30 minute o 15 minute sh	es) or s per candidat	
c) oral Langua credita Allocat Additio 300 h Teachi Referro Modul	examina examina age of as able for b tion of p onal info oad ng cycle ed to in b	ation of one candida ation in groups (grou seessment: German bonus laces rmation	ate each (15 t ups of 2, 10 t and/or Engli regulations f	to 30 minute o 15 minute sh	es) or s per candidat	
c) oral Langua credita Allocat Additio Worklo 300 h Teachi Referro Bachel	examina examina age of as ble for b tion of p onal info oad ng cycle ed to in l e appea lor's deg	ation of one candida ation in groups (grou seessment: German bonus laces rmation POI (examination rs in ree (1 major) Physic	ate each (15 t ups of 2, 10 t and/or Engli regulations f	to 30 minute o 15 minute sh	es) or s per candidat -degree progra	
c) oral Langua credita Allocat Additio Worklo 300 h Teachi Referro Bachel Bachel	examina examina age of as ble for b tion of p onal info oad ng cycle ed to in l e appea lor's deg	ation of one candida ation in groups (grou seessment: German bonus laces armation PO I (examination rs in rree (1 major) Physic rree (1 major) Nanos	ate each (15 t ups of 2, 10 t and/or Engli regulations f s (2015) tructure Tech	o 30 minute o 15 minute sh	es) or s per candidat -degree progra 15)	
c) oral Langua credita Allocat Additio Worklo 300 h Teachi Referro Bachel Bachel Bachel Bachel	examina examina age of as ble for b tion of p onal info oad ng cycle ed to in l e appea lor's deg lor's deg	ation of one candida ation in groups (grou seessment: German bonus laces rmation 	ate each (15 t ups of 2, 10 t and/or Engli regulations f s (2015) tructure Tech bace Comput	o 30 minute o 15 minute sh for teaching nnology (20) er Science (es) or s per candidat -degree progra 15)	
c) oral Langua credita Allocat Additio Worklo 300 h Teachi Referro Bachel Bachel Bachel Bachel Bachel	examina examina age of as alble for b tion of p onal info oad ng cycle ed to in b e appea lor's deg lor's deg lor's deg	ation of one candida ation in groups (grou seessment: German bonus laces rmation 	ate each (15 t ups of 2, 10 t and/or Engli regulations f s (2015) tructure Tech pace Comput onal Materia	to 30 minute o 15 minute sh for teaching nnology (201 er Science (ls (2015)	es) or s per candidat -degree progra 15) (2015)	
c) oral Langua credita Allocat Additio Worklo 300 h Teachi Teachi Bachel Bachel Bachel Bachel Bachel Bachel	examina examina age of as able for b tion of p onal info oad ng cycle ed to in l e appea lor's deg lor's deg lor's deg lor's deg	ation of one candida ation in groups (grou seessment: German bonus laces mmation 	ate each (15 t ups of 2, 10 t and/or Engli regulations f s (2015) tructure Tech bace Comput bace Comput	to 30 minute o 15 minute sh for teaching nnology (201 er Science (ls (2015)	es) or s per candidat -degree progra 15) (2015)	
c) oral Langua credita Allocat Additio Worklo 300 h Teachi Referro Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel	examina examina age of as albe for b tion of p onal info oad ng cycle ed to in l e appea lor's deg lor's deg lor's deg lor's deg lor's deg	ation of one candida ation in groups (grou sessment: German bonus laces mmation 	ate each (15 t ups of 2, 10 t and/or Engli regulations f s (2015) tructure Tech bace Comput bace Comput s (2020)	o 30 minute o 15 minute sh for teaching nnology (201 er Science (ls (2015) er Science (es) or s per candidat -degree progra 15) (2015) (2017)	
c) oral Langua credita Allocat Additio Worklo 300 h Teachi Referro Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel	examina examina age of as ble for b tion of p onal info oad ng cycle ed to in l e appea lor's deg lor's deg lor's deg lor's deg lor's deg lor's deg	ation of one candida ation in groups (grou sessment: German bonus laces rmation 	ate each (15 t ups of 2, 10 t and/or Engli regulations f s (2015) tructure Tech bace Comput onal Material bace Comput s (2020) tructure Tech	o 30 minute o 15 minute sh for teaching nnology (20) er Science (ls (2015) er Science (nnology (20)	es) or s per candidat -degree progra (2015) (2017) 20)	
c) oral Langua credita Allocat Modulia Worklo 300 h Teachi Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel	examina examina age of as alble for h tion of p onal info oad ad ad age cycle ad to in h e appea lor's deg lor's deg	ation of one candida ation in groups (grou seessment: German bonus laces rmation 	ate each (15 t ups of 2, 10 t and/or Engli regulations f s (2015) tructure Tech bace Comput s (2020) tructure Tech bace Comput	to 30 minute o 15 minute sh for teaching for teaching nology (201 er Science (ls (2015) er Science (nnology (201 er Science (es) or s per candidat -degree progra (2015) (2017) 20)	
c) oral Langua credita Allocat Additio Worklo 300 h Teachi Teachi Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel Bachel	examina examina age of as able for b tion of p onal info oad ng cycle ed to in l e appea lor's deg lor's deg	ation of one candida ation in groups (grou sessment: German bonus laces rmation 	ate each (15 t ups of 2, 10 t and/or Engli regulations f s (2015) tructure Tech bace Comput s (2020) tructure Tech bace Comput s (2020)	o 30 minute o 15 minutes sh for teaching nnology (201 er Science (ls (2015) er Science (nnology (201 er Science (ls (2021)	es) or s per candidat -degree progra (2015) (2017) 20)	

Module	e title				Abbreviation
Mathematics 1 for Students of Physics and Nanostructure 1 Module coordinator				echnology	10-M-PHY1-152-m01
Module	e coord	inator		Module offered by	
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathematics	
ECTS			Only after succ. com	npl. of module(s)	
8	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
		on numbers and functio aces, simple differential e		eries, differential ar	nd integral calculus in one varia-
Intende	ed lear	ning outcomes			
ple pro	blems		g sciences, in particu		ns to apply these methods to sim- physics and nanostructure techno-
Course	s (type	, number of weekly conta	ct hours, language —	- if other than Germa	an)
V (5) + Module	• •	t in: Ü: German or Englisł	1		
		essment (type, scope, la on on whether module ca			ation offered — if not every seme-
b) oral c) oral	examir examin Ige of a	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ssessment: German and, bonus	ach (approx. 20 minu of 2, 15 minutes per c	ites) or	
Allocat	ion of p	olaces			
	-				
Additio	nal inf	ormation			
Worklo	ad				
240 h					
Teachi	ng cycl	6			
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				
Module	e appea	irs in			
		gree (1 major) Physics (20	015)		
		gree (1 major) Nanostruct		5)	
		gree (1 major) Physics (20			
Bachel	or's de	gree (1 major) Nanostruct	ure Technology (202	o)	

Module	e title				Abbreviation
Mathematics 2 for Students of Physics and Nanostructure				Technology	10-M-PHY2-152-m01
Module coordinator				Module offered by	
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathematics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
8					
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
		nd systems of linear equ variables, differential equ			y, differential and integral calcu-
Intend	ed lear	ning outcomes			
se met	hods to		Iral and engineering s		itics. He/She learns to apply the- ar in the field of physics and na-
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	an)
V (5) +	Ü (2)				
Module	e taugh	t in: Ü: German or Englisł	1		
		s essment (type, scope, la on on whether module ca			ation offered — if not every seme-
b) oral c) oral	examir examin Ige of a	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ssessment: German and, bonus	ach (approx. 20 minu of 2, 15 minutes per ca	ites) or	
Allocat	ion of _l	olaces			
Additio	onal inf	ormation			
Worklo	ad				
240 h					
Teachi	ng cycl	e			
Referre	ed to in	LPO I (examination regu	lations for teaching-c	legree programmes)
Module	e appea	irs in			
		gree (1 major) Physics (20	015)		
		gree (1 major) Nanostruct	-	5)	
		gree (1 major) Physics (20	•,		
Bachel	or's de	gree (1 major) Nanostruct	ure Technology (202	o)	

Module	title			Abbreviation	
Program	mming course for students of N	10-M-PRG-152-m01			
Module coordinator			Module offered by		
Dean of	ean of Studies Mathematik (Mathematics) Institute of Mathematics			natics	
ECTS	Method of grading	Only after succ. con	pl. of module(s)		
3	(not) successfully completed				
Duratio		Other prerequisites			
1 semes	ster undergraduate				
Content	ts				
Basics of a modern programming language (e. g. C).					
Intende	ed learning outcomes				
	dent is able to work independe	ently on small program	ming exercises and	standard programm	ing problems
	iematics.	inty on small program		standard programm	
Courses	s (type, number of weekly conta	act hours language -	if other than Germa	n)	
P (2)	(type, number of weekty conta				
		;C;C		tion - 66	
	l of assessment (type, scope, la formation on whether module o			ition offered — if not	every seme-
	in the form of programming ex- ge of assessment: German and		25 nours)		
0	ment offered: Once a year, sum	, ,			
	ion of places				
Allocut					
		_			
Additio	nal information				
Worklo	ad				
90 h					
Teachin	ng cycle				
	<u> </u>				
Referre	d to in LPO I (examination reg	lations for teaching-	legree programmes)		
§ 22 N					
-	2 ·				
	e appears in	• ()			
	or's degree (1 major) Mathemat				
	or's degree (1 major) Physics (2	-	-)		
	or's degree (1 major) Nanostruc or's degree (1 major) Economat		5)		
	or's degree (1 major) Economat or's degree (1 major) Mathemat				
	or's degree (1 major) Mathemat	,	<u>م</u> رور (
	or's degree (1 major) Functiona		/(/		
First state examination for the teaching degree Gymnasium Mathematics (2015)					
Bachelor's degree (1 major) Mathematical Physics (2016)					
Bachelor's degree (1 major) Economathematics (2017)					
First state examination for the teaching degree Gymnasium Mathematics (2019)					
	or's degree (1 major) Physics (2				
Bachelor's degree (1 major) Nanostructure Technology (2020)					
	or's degree (1 major) Mathemat	•			
	or's degree (1 major) Functiona				
Bachelo	or's degree (1 major) Quantum	Technology (2021)			
	with 1 major Nanostructure Technology		generated 18-Apr-2025 • example a sector (180 ECTS) Nanostrukturta		page 59 / 150
2015)		ta record Bachel	or (180 ECTS) Nanostrukturte	cnnik - 2015	

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

				Abbreviation		
Imaging Sensors in Infrared 11-ASI-152-mo1						
Module coordinator			Module offered by			
Manag	Managing Director of the Institute of Applied Physics		Applied Physics	Faculty of Physics a	and Astronomy	
ECTS	<u> </u>	od of grading	Only after succ. cor	npl. of module(s)		
3	·	rical grade				
Duratio		Module level	Other prerequisites	5		
1 seme		undergraduate				
Conten					-	
range o up to n from bo sical o types o of neur	Infrared cameras are important experimental and technical tools, e.g. for measuring temperatures. The spectral range of infrared ranges from the visible spectrum, where the Sun is dominating as the natural source of light, up to microwaves and radiowaves with artificial emitters. There is distinct and sometimes dominating emission from bodies with ambient temperature in the infrared spectrum. The lecture provides an introduction to the physical optics of this spectral range and discusses: Peculiarities of infrared cameras and thermal images, different types of sensors (bolometer, quantum well, superlattice) as well as the evaluation of such sensors on the basis of neurophysiological aspects.					ce of light, ng emission n to the phy- ges, different
		ning outcomes				
		nave specific and adva and detector structures			ctral imaging. They k	now various
Course	s (type	, number of weekly con	tact hours, language –	– if other than Germa	ın)	
V (2) Module	e taugh	t in: German or English				
		essment (type, scope,	language — if other th	an German, examina	ition offered — if not	every seme-
		on on whether module				,
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: Once a year, summer semester 						If the method
Allocat	tion of p	olaces				
Additio	onal inf	ormation				
Workload						
90 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
	e appea					
		gree (1 major) Physics (gree (1 major) Nanostru	-	5)		
Bachelor's (2015)	with 1 maj	or Nanostructure Technology	-	• generated 18-Apr-2025 • ex lor (180 ECTS) Nanostrukturte	-	page 61 / 150

Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021) exchange program Physics (2023)

Module title Abbreviation					Abbreviation
Bachelor Thesis Nanostructure Technology					11-BA-N-152-m01
Module coordinator				Module offered by	
chairp	erson o	f examination committee		Faculty of Physics a	and Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
10	nume	rical grade			
Durati	on	Module level	Other prerequisites		
1 seme	ester	undergraduate			
Conter	nts				
					ask in the field of nanostructure riting of the Bachelor's thesis.
Intend	ed lear	ning outcomes			
structu	ure tech		ce of a supervisor, es	pecially in accordan	d engineering task from nano- ce with known methods and
Course	es (type	, number of weekly conta	ct hours, language –	- if other than Germa	in)
Νο cou	irses as	signed to module			
		sessment (type, scope, la on on whether module ca			tion offered — if not every seme-
		esis (approx. 25 pages) ssessment: German or Ei	nglish		
Allocat	tion of _l	olaces			
Additio	onal inf	ormation			
Time to	o compl	ete: 12 weeks.			
Worklo	oad				
300 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Nanostructure Technology (2020)					

Imaging Methods at the Synchroton 11-BMS-152-m01 Module coordinator Module offered by Managing Director of the Institute of Applied Physics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) 6 numerical grade Duration Module level Other prerequisites 1 semester undergraduate Contents Periodic and aperiodic signals. Fundamentals of discrete and exact Fourier transform. Basics of digital signal and image processing. Discretisation of signals / sampling theorem (Shannon). Homogeneous and linear filter, the convolution product. Tapering functions and interpolation of images. The Parsival theorem, correlation and energetic aspects. Statistical signals, image noise, moments, stationary signals. Tomography: Hankel and Radou transform. Intended learning outcomes Intended learning outcomes The students know the principles of digital image and signal processing. They know the ways of functioning and applications of different image processing methods and are able to apply them in practice. Courses (type, number of weekly contact hours, 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 to 120 minutes) or o) or al examination of one candidate each (approx. 30 minutes) or					
Managing Director of the Institute of Applied Physics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) 6 numerical grade Duration Module level Other prerequisites 1 semester undergraduate Contents Periodic and aperiodic signals. Fundamentals of discrete and exact Fourier transform. Basics of digital signal and image processing. Discretisation of signals / sampling theorem (Shannon). Homogeneous and linear filter, the convolution product. Tapering functions and interpolation of images. The Parsival theorem, correlation and energetic aspects. Statistical signals, image noise, moments, stationary signals. Tomography: Hankel and Rador transform. Intended learning outcomes The students know the principles of digital image and signal processing. They know the ways of functioning and applications of different image processing methods and are able to apply them in practice. Courses (type, number of weekly contact hours, language — if other than German) V (3) + R (1) Module taught in: German or English Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) a) written examination (approx. 90 to 120 minutes) or b) oral examination in groups (groups of 2, approx. 90 mi					
ECTS Method of grading Only after succ. compl. of module(s) 6 numerical grade Duration Module level Other prerequisites 1 semester undergraduate Contents Periodic and aperiodic signals. Fundamentals of discrete and exact Fourier transform. Basics of digital signal and image processing. Discretisation of signals / sampling theorem (Shannon). Homogeneous and linear filter, the convolution product. Tapering functions and interpolation of images. The Parsival theorem, correlation and energetic aspects. Statistical signals, image noise, moments, stationary signals. Tomography: Hankel and Rador transform. Intended learning outcomes Method of different image processing methods and are able to apply them in practice. Courses (type, number of weekly contact hours, language — if other than German) V (3) + R (1) 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 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or or al examination in groups (groups of 2, approx. 30 minutes) or o) are examination on schosen as method of assessment, this may be changed and assessment may instead take th					
6 numerical grade Duration Module level Other prerequisites 1 semester undergraduate Contents Periodic and aperiodic signals. Fundamentals of discrete and exact Fourier transform. Basics of digital signal and image processing. Discretisation of signals / sampling theorem (Shannon). Homogeneous and linear filter, the convolution product. Tapering functions and interpolation of images. The Parsival theorem, correlation and energetic aspects. Statistical signals, image noise, moments, stationary signals. Tomography: Hankel and Rador transform. Intended learning outcomes The students know the principles of digital image and signal processing. They know the ways of functioning and applications of different image processing methods and are able to apply them in practice. Courses (type, number of weekly contact hours, language — if other than German) V (3) + R (1) Module taught in: German or English Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination of an elaximation of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.					
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Assessment offered: Once a year, summer semester					
Allocation of places					
Additional information					
Workload					
180 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Master's degree (1 major) Functional Materials (2016) Bachelor's degree (1 major) Physics (2020)					
Bachelor's with 1 major Nanostructure Technology JMU Würzburg • generated 18-Apr-2025 • exam. reg. da- page 64 / 150 (2015) ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015 page 64 / 150					

Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Functional Materials (2022) exchange program Physics (2023) Master's degree (1 major) Functional Materials (2025)

Module title					Abbreviation		
Coating Technologies based on Vapour Deposition					11-BVG-152-m01		
Module coordinator				Module offered by			
		ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy		
ECTS	<u> </u>	od of grading	Only after succ. com	· · · · ·			
5	nume	rical grade					
Duratio		Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
		ical principles of PVD an ation of layer materials o		nd processes. Coati	ng deposit and layer characteri-		
Intende	ed learı	ning outcomes					
		nave advanced knowledg rial relevance and variety		processes in the gas	eous phase and gain insights in-		
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	in)		
V (3) + Module	• •	t in: German or English					
		e ssment (type, scope, la on on whether module ca			tion offered — if not every seme-		
 c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: Once a year, summer semester 							
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
150 h							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module			une Teelensterer (e	-)			
		gree (1 major) Nanostruct ee (1 maior) Functional M		5)			
master	Master's degree (1 major) Functional Materials (2016)						

Module title				Abbreviation	
Current Top	pics in Nanostructure Techn	ology		11-BXN5-152-m01	
Module coordinator			Module offered by		
chairpersor	n of examination committee		Faculty of Physics a	ind Astronomy	
	thod of grading	Only after succ. com	pl. of module(s)		
5 nur	merical grade				
Duration	Module level	Other prerequisites			
1 semester	undergraduate	Approval from exam	ination committee re	equired.	
Contents					
Current top or study ab		Accredited academi	c achievements, e.g.	. in case of change of university	
Intended le	earning outcomes				
nology or n ledge. They		nd the measuring and ject-specific contexts	evaluation method and know the appli		
V (2) + R (2)					
	assessment (type, scope, la nation on whether module ca			tion offered — if not every seme-	
written examination (approx. 90 to 120 minutes) or oral examination of one candidate each (approx. 30 minutes) or oral examination in groups (groups of 2, approx. 30 minutes per candidate) or project report (approx. 8 to 10 pages) or presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English					
Allocation		<u> </u>			
Additional	information				
Workload					
150 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelor's degree (1 major) Nanostructure Technology (2015)					
	degree (1 major) Nanostruct degree (1 major) Nanostruct				

Module title				Abbreviation		
Current Topics in Nanostructure Technology					11-BXN6-152-m01	
Module coordinator				Module offered by	<u> </u>	
chairpe	erson o	f examination committee		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 seme	ster	undergraduate	Approval from exam	ination committee re	equired.	
Conten	ts					
Current or stud	•		Accredited academi	c achievements, e.g.	. in case of change of university	
Intende	ed learı	ning outcomes				
nology ledge.	or nan They ar		nd the measuring and ject-specific contexts	l evaluation method and know the appli		
V (3) +	R (1)					
		s essment (type, scope, la on on whether module ca			tion offered — if not every seme-	
written examination (approx. 90 to 120 minutes) or oral examination of one candidate each (approx. 30 minutes) or oral examination in groups (groups of 2, approx. 30 minutes per candidate) or project report (approx. 8 to 10 pages) or presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.						
Allocat	<u> </u>	ssessment: German and, blaces				
Additio	nal inf	ormation				
Worklo	ad					
180 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
		gree (1 major) Nanostruct				
Bachel	Bachelor's degree (1 major) Nanostructure Technology (2020)					

Module title					Abbreviation				
Current	Current Topics in Semiconductor Electronics				11-BXN6A-152-m01				
Module	e coord	inator		Module offered by					
chairpe	erson o	f examination committee		Faculty of Physics a	nd Astronomy				
ECTS	Methe	od of grading	Only after succ. con	pl. of module(s)					
6 numerical grade									
Duratio	on	Module level	Other prerequisites						
1 semester unknown Approval by examination committee required.					uired.				
Contents									
No info	rmatio	n on contents available.							
Intend	ed lear	ning outcomes							
No info	rmatio	n on intended learning o	utcomes available.						
Course	s (type	, number of weekly conta	ict hours, language –	- if other than Germa	n)				
V (3) +	R (1)								
		sessment (type, scope, la ion on whether module c			tion offered — if not every seme-				
of asse nation	essmen date at		r must inform student		mination in groups. If the methoo weeks prior to the original exami-				
Allocat	ion of _l	places							
Additio	onal inf	ormation							
Workload									
	au								
180 h	au								
		e							
180 h		e							
180 h Teachi i 	ng cycl	e LPOI (examination regu	lations for teaching-o	legree programmes)					
180 h Teachi i 	ng cycl		lations for teaching-o	degree programmes)					
180 h Teachi i 	ng cycl ed to in	LPOI (examination regu	lations for teaching-o	degree programmes)					
180 h Teachin Referre Module	ng cycl ed to in e appea	LPOI (examination regu							
180 h Teachin Referre Module Bachel Bachel	ng cycl ed to in e appea or's de or's de	LPOI (examination regu	ture Technology (201 ture Technology (202	5)					

Module title				Abbreviation		
Current Topics in Nanostructure Technology					11-BXN8-152-m01	
Module coordinator				Module offered by	<u> </u>	
chairpe	erson of	f examination committee		Faculty of Physics a	ind Astronomy	
ECTS		od of grading	Only after succ. com	pl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate	Approval from exam	ination committee re	equired.	
Conten	ts					
Current or stud	•		Accredited academi	c achievements, e.g	. in case of change of university	
Intende	ed learr	ning outcomes				
nology ledge. 1	or nand They ar		nd the measuring and ject-specific contexts	l evaluation method and know the appli		
V (4) +					·	
		e ssment (type, scope, la on on whether module ca			tion offered — if not every seme-	
written examination (approx. 90 to 120 minutes) or oral examination of one candidate each (approx. 30 minutes) or oral examination in groups (groups of 2, approx. 30 minutes per candidate) or project report (approx. 8 to 10 pages) or presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.						
Allocat	-	ssessment: German and, Jlaces				
Additio	nal inf	ormation				
Workload						
240 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
	Bachelor's degree (1 major) Nanostructure Technology (2015)					
Bachel	or's deg	gree (1 major) Nanostruct	ure Technology (202	0)		

Module title				Abbreviation		
Current Topics Physics					11-BXP5-152-m01	
Module coordinator				Module offered by		
				•	and Astronomy	
ECTS	-	f examination committee od of grading	Only after succ. com	Faculty of Physics a		
5	-	rical grade				
Duratio		Module level	Other prerequisites			
1 seme		undergraduate	Approval from exam	ination committee r	equired.	
Conter	Contents					
Current topics of Experimental and Theoretical Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.						
Intend	ed lear	ning outcomes				
Theore subdis knowle	tical Ph cipline edge. Th	ysics of the Bachelor's p of Physics and understan ney are able to classify th	rogramme of Nanostr nd the measuring and e subject-specific co	ucture Technology. I/or calculation methet ntexts and know the		
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	an)	
V (2) +	R (2)					
		s essment (type, scope, la on on whether module ca			tion offered — if not every seme-	
pages) or presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English						
	tion of p		0.1			
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Bachelor's degree (1 major) Nanostructure Technology (2015)						
	Bachelor's degree (1 major) Nanostructure Technology (2020)					
	Bachelor's degree (1 major) Quantum Technology (2021)					
Modul	e studie	es (Bachelor) Quantum Te	echnology (2021)			

Module title					Abbreviation	
Curren	t Topic	s in Physics			11-BXP6-152-m01	
Module	e coord	inator		Module offered by		
chairpe	erson o	f examination committee		Faculty of Physics a	nd 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 seme	ster	undergraduate	Approval from exam	ination committee re	equired.	
Conten	Contents					
	Current topics of Experimental and Theoretical Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.					
Intend	ed lear	ning outcomes				
Theore subdis knowle	tical Ph cipline edge. Th	ysics of the Bachelor's p	rogramme of Nanosti nd the measuring and e subject-specific co	ructure Technology. I/or calculation methet ntexts and know the		
		, number of weekly conta	<u>ct nours, language –</u>	- II other than Germa	II <i>)</i>	
V (3) +						
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-	
 written examination (approx. 90 to 120 minutes) or oral examination of one candidate each (approx. 30 minutes) or oral examination in groups (groups of 2, approx. 30 minutes per candidate) or project report (approx. 8 to 10 pages) or presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English 						
Additio	onal inf	ormation				
Worklo	ad					
180 h						
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Bachelor's degree (1 major) Nanostructure Technology (2015)						
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) Bachelor's degree (1 major) Nanostructure Technology (2020)						
		gree (1 major) Nanostruct gree (1 major, 1 minor) Ph		0)		
		gree (1 major, 1 minor) Pri gree (1 major) Quantum T	•			
		es (Bachelor) Quantum Te				
module studies (Bachelof) Quantum recimology (2021)						

Module title			Abbreviation		
Current	Current Topics in Physics 11-BXP8-152-m01				
Module	coordinator		Module offered by		
chairper	rson of examination committee		Faculty of Physics a	nd Astronomy	
ECTS	Method of grading	Only after succ. con	npl. of module(s)		
8	numerical grade				
Duration	n Module level	Other prerequisites			
1 semes	ter undergraduate	Approval from exam	ination committee re	equired.	
Content	S				
	topics of Experimental and The of university or study abroad.	oretical Physics. Acc	redited academic ac	hievements, e.g. in case of	
Intende	d learning outcomes				
Theoreti subdisci knowled	lents have advanced competer cal Physics of the Bachelor's p ipline of Physics and understar lge. They are able to classify th (type, number of weekly conta	rogramme of Nanosti nd the measuring and e subject-specific co	ructure Technology. I/or calculation mether ntexts and know the	They have knowledge of a current nods necessary to acquire this application areas.	
V (4) + R	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	, , , , , , , , , , , , , , , , , , , ,		·	
Method ster, info	of assessment (type, scope, la prmation on whether module ca	an be chosen to earn	a bonus)	tion offered — if not every seme- didate each (approx. 30 minutes)	
pages) of If a writt stead ta of asses nation d Languag	or presentation/talk (approx. 30 en examination was chosen as ke the form of an oral examina sment is changed, the lecturer late at the latest. ge of assessment: German and	o minutes). method of assessme tion of one candidate must inform student	ent, this may be chai e each or an oral exa	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method weeks prior to the original exami-	
Allocalle	on of places				
 Addition	nal information	<u>.</u>			
Workloa	ıd				
240 h					
Teaching	g cycle				
Referred	to in LPO I (examination regu	lations for teaching-o	degree programmes)		
Module appears in					
Bachelo Bachelo Bachelo Bachelo	Module appears inBachelor's degree (1 major) Nanostructure Technology (2015)Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015)Bachelor's degree (1 major) Nanostructure Technology (2020)Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)Bachelor's degree (1 major) Quantum Technology (2021)Module studies (Bachelor) Quantum Technology (2021)				

Module	e title				Abbreviation
Selecte	ed Topi	cs in Energy and Materia	l Science		11-CSEM6-152-m01
Module	coord	inator		Module offered by	
	chairperson of examination committee			Faculty of Physics a	nd Astronomy
ECTS		od of grading	Only after succ. con		
6		rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate	Approval from exam	ination committee re	equired.
Conten	ts				
Selecte	d topic	s of energy and material	s research.		
Intende	ed lear	ning outcomes			
tion me	ethods				tand the measuring and evalua- subject-specific contexts and
Course	s (type	, number of weekly conta	ct hours, language –	· if other than Germa	ın)
V (3) +	R (1)				
		e ssment (type, scope, la on on whether module ca			tion offered — if not every seme-
stead to of asse nation	ake the ssmen date at	form of an oral examina	tion of one candidate must inform student	e each or an oral exa	nged and assessment may in- mination in groups. If the method weeks prior to the original exami-
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
180 h					
Teachi	ng cycl	9			
Referre	d to in	LPO I (examination regu	lations for teaching-o	legree programmes)	
Module	e appea	irs in			
Bachel	or's de	gree (1 major) Nanostruct	ure Technology (201	5)	
		gree (1 major) Nanostruct		o)	
		gree (1 major) Quantum T			
Module	e studie	es (Bachelor) Quantum Te	ecnnology (2021)		

Module	e title				Abbreviation					
Selecte	ed Topi	cs in Solid State Physics			11-CSF6-152-m01					
Module coordinator			i	Module offered by						
				•	nd Action amu					
ECTS		f examination committee od of grading	Only after succ. com	Faculty of Physics a	ind Astronomy					
6		rical grade								
Duratio		Module level	Other prorequisites							
1 semes		undergraduate	Other prerequisites Approval from exam	ination committee re	equired					
Content		undergraduate			cquircu.					
		a of Collid Ctoto Dhusion								
		s of Solid-State Physics.								
		ning outcomes								
and eva	aluatio				nd understand the measuring classify the subject-specific con-					
Courses	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)					
V (3) + F	R (1)									
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-					
of asses nation o	ssmen date at		must inform student		mination in groups. If the method weeks prior to the original exami-					
Allocati	ion of p	olaces								
Additio	nal inf	ormation								
Worklo	ad									
180 h										
Teachin	ng cycl	e								
Referre	d to in	LPOI (examination regu	lations for teaching-d	legree programmes)						
Module	e appea	ars in								
		gree (1 major) Physics (20	015)							
			-	5)	Bachelor's degree (1 major) Nanostructure Technology (2015)					
Module	e studie	es (Bachelor) Physics (20	19)	Module studies (Bachelor) Physics (2019)						
		Bachelor's degree (1 major) Physics (2020)								
Bachelor's degree (1 major) Nanostructure Technology (2020)										
		gree (1 major) Nanostruct	ure Technology (2020	b)						
Bachelo	or's de		ure Technology (2020 Technology (2021)	b)						

Module title					Abbreviation
Selecte	ed Topi	cs in Nanostructure Tech	inology		11-CSN6-152-m01
Module coordinator				Module offered by	·
chairpe	erson o	f examination committee	<u>.</u>	Faculty of Physics a	and Astronomy
ECTS		od of grading	Only after succ. con	npl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate	Approval from exam	ination committee r	equired.
Conten	ts				
Selecte	d topic	s of nanostructure techn	ology.		
Intende	ed learı	ning outcomes			
technic	al metl				nology and of the scientific or y the subject-specific contexts
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	ın)
V (3) +	R (1)				
Method of assessment (type, scope, language — if other than German, examination offered — if not every seme- ster, information on whether module can be chosen to earn a bonus) written examination (approx. 90 to 120 minutes) or oral examination of one candidate each (approx. 30 minutes) or oral examination in groups (groups of 2, approx. 30 minutes per candidate) or project report (approx. 8 to 10 pages) or presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Allocation of places					
written or oral pages) If a writ stead ta of asse nation Langua	examin examin or pres ten exa ake the ssmen date at ge of a	nation (approx. 90 to 120 ation in groups (groups entation/talk (approx. 30 amination was chosen as form of an oral examina t is changed, the lecturen the latest. ssessment: German and	o minutes) or oral exa of 2, approx. 30 minu o minutes). 5 method of assessme tion of one candidate r must inform student	mination of one can tes per candidate) o ent, this may be cha e each or an oral exa	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method
written or oral pages) If a writ stead ta of asse nation Langua Allocat	examin examin or pres ten exa ake the ssmen date at ge of a ion of p	nation (approx. 90 to 120 ation in groups (groups entation/talk (approx. 30 amination was chosen as form of an oral examina t is changed, the lecturen the latest. ssessment: German and	o minutes) or oral exa of 2, approx. 30 minu o minutes). 5 method of assessme tion of one candidate r must inform student	mination of one can tes per candidate) o ent, this may be cha e each or an oral exa	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method
written or oral pages) If a writ stead ta of asse nation Langua Allocat	examin examin or pres ten exa ake the ssmen date at ge of a ion of p	nation (approx. 90 to 120 ation in groups (groups sentation/talk (approx. 3 amination was chosen as e form of an oral examina t is changed, the lecturen the latest. ssessment: German and blaces	o minutes) or oral exa of 2, approx. 30 minu o minutes). 5 method of assessme tion of one candidate r must inform student	mination of one can tes per candidate) o ent, this may be cha e each or an oral exa	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method
written or oral pages) If a writ stead ta of asse nation Langua Allocat	examin examin or pres ten exa ake the ssmen date at ge of a ion of p mal info	nation (approx. 90 to 120 ation in groups (groups sentation/talk (approx. 3 amination was chosen as e form of an oral examina t is changed, the lecturen the latest. ssessment: German and blaces	o minutes) or oral exa of 2, approx. 30 minu o minutes). 5 method of assessme tion of one candidate r must inform student	mination of one can tes per candidate) o ent, this may be cha e each or an oral exa	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method
written or oral pages) If a writ stead ta of asse nation Langua Allocat 	examin examin or pres ten exa ake the ssmen date at ge of a ion of p mal info	nation (approx. 90 to 120 ation in groups (groups sentation/talk (approx. 3 amination was chosen as e form of an oral examina t is changed, the lecturen the latest. ssessment: German and blaces	o minutes) or oral exa of 2, approx. 30 minu o minutes). 5 method of assessme tion of one candidate r must inform student	mination of one can tes per candidate) o ent, this may be cha e each or an oral exa	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method
written or oral pages) If a writ stead ta of asse nation Langua Allocat Additio Worklo	examin examin or pres ten exa ake the ssmen date at ge of a ion of p nal inf ad	nation (approx. 90 to 120 ation in groups (groups sentation/talk (approx. 3 amination was chosen as form of an oral examina t is changed, the lecturen the latest. ssessment: German and places	o minutes) or oral exa of 2, approx. 30 minu o minutes). 5 method of assessme tion of one candidate r must inform student	mination of one can tes per candidate) o ent, this may be cha e each or an oral exa	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method
written or oral pages) If a writ stead ta of asse nation Langua Allocat Additio 180 h	examin examin or pres ten exa ake the ssmen date at ge of a ion of p nal inf ad	nation (approx. 90 to 120 ation in groups (groups sentation/talk (approx. 3 amination was chosen as form of an oral examina t is changed, the lecturen the latest. ssessment: German and places	o minutes) or oral exa of 2, approx. 30 minu o minutes). 5 method of assessme tion of one candidate r must inform student	mination of one can tes per candidate) o ent, this may be cha e each or an oral exa	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method
written or oral pages) If a writ stead ta of asse nation Langua Allocat Additio 180 h Teachin 	examin examin or pres ten exa ake the ssmen date at ge of a ion of p nal info ad	nation (approx. 90 to 120 ation in groups (groups sentation/talk (approx. 3 amination was chosen as form of an oral examina t is changed, the lecturen the latest. ssessment: German and places	o minutes) or oral exa of 2, approx. 30 minu o minutes). s method of assessme tion of one candidate r must inform student /or English	mination of one can tes per candidate) o ent, this may be cha e each or an oral exa is about this by four	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method weeks prior to the original exami-
written or oral pages) If a writ stead ta of asse nation Langua Allocat Additio 180 h Teachin 	examin examin or pres ten exa ake the ssmen date at ge of a ion of p nal info ad	nation (approx. 90 to 120 ation in groups (groups (sentation/talk (approx. 3) amination was chosen as a form of an oral examina t is changed, the lecturen the latest. ssessment: German and places	o minutes) or oral exa of 2, approx. 30 minu o minutes). s method of assessme tion of one candidate r must inform student /or English	mination of one can tes per candidate) o ent, this may be cha e each or an oral exa is about this by four	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method weeks prior to the original exami-
written or oral pages) If a writ stead ta of asse nation Langua Allocat Additio 180 h Teachin 	examin examin or pres ten exa ake the ssmen date at ge of a ion of p nal info ad	ation (approx. 90 to 120 ation in groups (groups (sentation/talk (approx. 3) amination was chosen as a form of an oral examina t is changed, the lecturent the latest. ssessment: German and blaces ormation	o minutes) or oral exa of 2, approx. 30 minu o minutes). s method of assessme tion of one candidate r must inform student /or English	mination of one can tes per candidate) o ent, this may be cha e each or an oral exa is about this by four	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method weeks prior to the original exami-
written or oral pages) If a writ stead ta of asse nation Langua Allocat Worklo 180 h Teachin Referre Module	examin examin or pres ten exa ake the ssmen date at ge of a ion of p nal info ad	ation (approx. 90 to 120 ation in groups (groups (sentation/talk (approx. 3) amination was chosen as a form of an oral examina t is changed, the lecturent the latest. ssessment: German and blaces ormation	o minutes) or oral exa of 2, approx. 30 minu o minutes). s method of assessme tion of one candidate r must inform student /or English	mination of one can tes per candidate) o ent, this may be cha e each or an oral exa s about this by four degree programmes)	r project report (approx. 8 to 10 nged and assessment may in- mination in groups. If the method weeks prior to the original exami-

Module					Abbreviation
Atoms	and Qu	anta - Exercises			11-E-AA-152-m01
Module	e coord	inator		Module offered by	<u> </u>
Manag	ing Dire	ector of the Institute of <i>I</i>	Applied Physics	Faculty of Physics	and Astronomy
ECTS	Metho	od of grading	Only after succ. c	ompl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisit	es	
1 seme	ster	undergraduate			
Conten	ts				
atoms, the hyc	experi Irogen	mental fundamental lav	vs of Quantum Physi l fields, multi-electro	ics, the Schrödinger e on atoms, optical trans	/. Among others Structure of quation, quantum mechanics of iitions and spectroscopy, laser,
Intende	ed lear	ning outcomes			
cular P	hysics.		matically formulate	physical contexts of A	nena as well as Atomic and Mole tomic and Quantum Physics and al tasks.
Course	s (type	, number of weekly con	tact hours, language	e — if other than Germa	an)
Ü (2)					
Module	e taugh	t in: Ü: German or Engli	sh		
		sessment (type, scope, ion on whether module			ation offered — if not every seme
		nation (approx. 120 min ssessment: German an			
Allocat	ion of _l	olaces			
Additio	nal inf	ormation			
Worklo	ad				
150 h					
Teachi	ng cycl	e			
Referre	ed to in	LPO I (examination reg	gulations for teaching	g-degree programmes)
 Module	e appea	ars in			
 Module Bachel		a rs in gree (1 major) Physics (:	2015)		

Module title					Abbreviation	
Principl	es of l	mage Processing			11-EBV-152-m01	
Module	coord	nator		Module offered by		
	Managing Director of the Institute of Applied Physics			Faculty of Physics a	nd Astronomy	
1		d of grading	Only after succ. con	pl. of module(s)		
-	n	rical grade				
Duratio		Module level	Other prerequisites			
1 semester undergraduate						
transfor tic imag	ction to m. His e reco	o image processing. Pict togram equalisation (e.g gnition: Segmentation, o e-dimensional images.	g. image brightening)	and pixel connectivit	ty (e.g. noise reducti	on). Automa-
Intende	d learr	ing outcomes				
and the le to ind al softw	ory of s lepend are an	nave specific and advance signal processing for ima ently work with literatur d are able to process im	ages and have corres e, they understand th ages for the analysis	oonding knowledge o e characteristics of i of experiments with	of image generation. mage processing wit imaging measuring r	They are ab- th commerci-
	(type,	number of weekly conta	act nours, tanguage –	- II other than Germa	n)	
V (2) Module	taugh	t in: German or English				
		essment (type, scope, la on on whether module c			tion offered — if not	every seme-
b) oral e c) oral e d) proje e) prese If a writt stead ta of asses nation c Languag	 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: Once a year, winter semester 					
Allocati	on of p	olaces				
Additio	nal info	ormation				
			_			
Workloa	ad					
90 h						
Teachin	g cycl	9				
Referred	d to in	LPOI (examination regu	llations for teaching-	legree programmes)		
Module	appea	rs in				
Bachelo	or's deg	gree (1 major) Physics (2 gree (1 major) Nanostruc gree (1 major) Physics (2	ture Technology (201	5)		
Bachelor's w (2015)	vith 1 maj	or Nanostructure Technology	-	generated 18-Apr-2025 • exa or (180 ECTS) Nanostrukturtee	-	page 78 / 150



Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021) exchange program Physics (2023)

8 numerical grade Duration Module level Other precedent 1 semester undergraduate Admission precedent 1 semester undergraduate Generative 1 semester undergraduate Itemperature 2 Heat conduction, heat transfer, diffusion, convecte Feent (also soli	Abbreviation
Managing Director of the Institute of Applied Physics ECTS Method of grading Only after some statements 8 numerical grade Duration Module level Other precession 1 semester undergraduate Admission provession provessint provessing provessing provession provession provession provessi	11-E-E-152-m01
Managing Director of the Institute of Applied Physics ECTS Method of grading Only after site 8 numerical grade Duration Module level Other preference 1 semester undergraduate Admission provestigation approx. 50% lecturer will of the semestigation approx. 50% lecturer will of the semestigation of the semestical semestical theorems of thermodynamics, entropartitical semestical theorems of thermodynamics, entropartitical semestical theorems of thermodynamics, entropartitical semestical semestical semestical set of the set of the semestical set of the semestical	
ECTS Method of grading Only after set 8 numerical grade Duration Module level Other preference 1 semester undergraduate Admission p 1 set set test approx.50% 1 Heat engines, working diagrams, efficiency, exam set set 2 Heat conduction, heat transfer, diffusion, convect set	Module offered by
8 numerical grade Duration Module level Other prered 1 semester undergraduate Admission p 1 semester undergraduate Admission p 13 exercise s approx. 50% lecturer will of the semester of the semester approx. 50% 1. Thermodynamics (linked to 11-E-M); temperature at 2. Heat conduction, heat transfer, diffusion, convect 3. Fundamental theorems of thermodynamics, entro 4. Heat engines, working diagrams, efficiency, examt 5. Real gases and liquids, states of matter (also soli phenomena (opalescence), coexistence region, Joul 6. Electrostatics, basic concepts: Electrical charge, f point charge; 7. Gaussian sentence, related to Coulomb's law, def cial symmetries; divergence and GS in differential for 8. Electrical potential, working in the E-box, electric. equipotential surfaces; several important examples lace effects, Segner wheel; 9. Matter in the E-field, charge in a homogeneous field	
Duration Module level Other preret 1 semester undergraduate Admission p 13 exercise s approx. 50% lecturer will of the semes Contents . 1. Thermodynamics (linked to 11-E-M); temperature a 2. Heat conduction, heat transfer, diffusion, convect 3. Fundamental theorems of thermodynamics, entro 4. Heat engines, working diagrams, efficiency, exam 5. Real gases and liquids, states of matter (also soli phenomena (opalescence), coexistence region, Joul 6. Electrostatics, basic concepts: Electrical charge, f point charge; 7. Gaussian sentence, related to Coulomb's law, def cial symmetries; divergence and GS in differential fo 8. Electrical potential, working in the E-box, electric. equipotential surfaces; several important examples lace effects, Segner wheel; 9. Matter in the E-field, charge in a homogeneous field	ucc. compl. of module(s)
1 semester undergraduate Admission p 13 exercise s approx. 50% lecturer will of the semest Contents 1. Thermodynamics (linked to 11-E-M); temperature at conduction, heat transfer, diffusion, convect 3. Fundamental theorems of thermodynamics, entro 4. Heat engines, working diagrams, efficiency, examt 5. Real gases and liquids, states of matter (also soli phenomena (opalescence), coexistence region, Joul 6. Electrostatics, basic concepts: Electrical charge, f point charge; 7. Gaussian sentence, related to Coulomb's law, def cial symmetries; divergence and GS in differential for 8. Electrical potential, working in the E-box, electrical equipotential surfaces; several important examples lace effects, Segner wheel; 9. Matter in the E-field, charge in a homogeneous field	
13 exercises approx. 50% lecturer will of the semest Contents 1. Thermodynamics (linked to 11-E-M); temperature at 2. Heat conduction, heat transfer, diffusion, convect 3. Fundamental theorems of thermodynamics, entro 4. Heat engines, working diagrams, efficiency, examt 5. Real gases and liquids, states of matter (also soli phenomena (opalescence), coexistence region, Joul 6. Electrostatics, basic concepts: Electrical charge, f point charge; 7. Gaussian sentence, related to Coulomb's law, deficial symmetries; divergence and GS in differential for 8. Electrical potential, working in the E-box, electrical equipotential surfaces; several important examples lace effects, Segner wheel; 9. Matter in the E-field, charge in a homogeneous field	
approx. 50% lecturer will of the semestContents1. Thermodynamics (linked to 11-E-M); temperature at 2. Heat conduction, heat transfer, diffusion, convect 3. Fundamental theorems of thermodynamics, entro 4. Heat engines, working diagrams, efficiency, exam 5. Real gases and liquids, states of matter (also soli phenomena (opalescence), coexistence region, Joul 6. Electrostatics, basic concepts: Electrical charge, f point charge; 7. Gaussian sentence, related to Coulomb's law, deficial symmetries; divergence and GS in differential for 8. Electrical potential, working in the E-box, electrical equipotential surfaces; several important examples lace effects, Segner wheel; 9. Matter in the E-field, charge in a homogeneous field	rerequisite to assessment: completion of exercises (approx.
Contents1. Thermodynamics (linked to 11-E-M); temperature a2. Heat conduction, heat transfer, diffusion, convect3. Fundamental theorems of thermodynamics, entro4. Heat engines, working diagrams, efficiency, examt5. Real gases and liquids, states of matter (also soliphenomena (opalescence), coexistence region, Joul6. Electrostatics, basic concepts: Electrical charge, f7. Gaussian sentence, related to Coulomb's law, defcial symmetries; divergence and GS in differential for8. Electrical potential, working in the E-box, electricalequipotential surfaces; several important exampleslace effects, Segner wheel;9. Matter in the E-field, charge in a homogeneous field	sheets per semester). Students who successfully completed
Contents1. Thermodynamics (linked to 11-E-M); temperature at 2. Heat conduction, heat transfer, diffusion, convect 3. Fundamental theorems of thermodynamics, entro 4. Heat engines, working diagrams, efficiency, exam 5. Real gases and liquids, states of matter (also soli phenomena (opalescence), coexistence region, Joul 6. Electrostatics, basic concepts: Electrical charge, f point charge; 7. Gaussian sentence, related to Coulomb's law, deficial symmetries; divergence and GS in differential for 8. Electrical potential, working in the E-box, electrical equipotential surfaces; several important examples lace effects, Segner wheel; 9. Matter in the E-field, charge in a homogeneous field	of exercises will qualify for admission to assessment. The
Contents 1. Thermodynamics (linked to 11-E-M); temperature a 2. Heat conduction, heat transfer, diffusion, convect 3. Fundamental theorems of thermodynamics, entro 4. Heat engines, working diagrams, efficiency, exam 5. Real gases and liquids, states of matter (also soli phenomena (opalescence), coexistence region, Joul 6. Electrostatics, basic concepts: Electrical charge, f point charge; 7. Gaussian sentence, related to Coulomb's law, def cial symmetries; divergence and GS in differential fo 8. Electrical potential, working in the E-box, electric. equipotential surfaces; several important examples lace effects, Segner wheel; 9. Matter in the E-field, charge in a homogeneous fiele	inform students about the respective details at the beginning
 Thermodynamics (linked to 11-E-M); temperature a Heat conduction, heat transfer, diffusion, convect Fundamental theorems of thermodynamics, entrodynamics, entrody	ster.
 Heat conduction, heat transfer, diffusion, convect Fundamental theorems of thermodynamics, entro Heat engines, working diagrams, efficiency, exam Real gases and liquids, states of matter (also soli phenomena (opalescence), coexistence region, Joul Electrostatics, basic concepts: Electrical charge, f point charge; Gaussian sentence, related to Coulomb's law, deficial symmetries; divergence and GS in differential for Electrical potential, working in the E-box, electrical equipotential surfaces; several important examples lace effects, Segner wheel; Matter in the E-field, charge in a homogeneous field 	
 Capacitor, mirror charge, definition, capacity; pla dia in the capacitor; electrical polarisation, displace ectric displacement; electrolytic capacitor; Piezoele Electricity, introduction, current density, drift velotize. Resistance and conductivity, resistivity, temperation ohmic, NTC, PTC); Circuits, electrical networks, Kirchhoff's rules (m suring instruments; Wheatstone bridge; Power and energy in the circuit; Capacitor charge Transfer mechanisms, conduction in solids: Banif. Magnetostatics, fundamental laws; permanent rignetic field; Amper's Law, analogous to e-box, magrif. Vector potential, formal derivation, analogous to Helmholtz coils; Moving charge in the static magnetic field, curre pole field; movement paths, mass spectrometer, Wi 9. matter in the magnetic field, effects of the field of ferromagnetism; magn. moment of the electron, bel 20. induction, Faraday's law of induction, Lenz's rule inductance, self-induction; applications: Transforme 21. Maxwell's displacement current, choice of integri equation; Maxwell equations; AC: Fundamentals, sinusoidal vibrations, amplitications 	tion, radiant heat; py, irreversibility, Maxwell's demon; ple: Stirling engine; ds), van der Waals, critical point, phase transitions, critical e-Thomson; forces; electric field, reps. field concept, field lines, field of a finition of "river"; Gaussian surface, divergence theorem; spe- orm; potential, potential difference, voltage; potential equation, : Sphere, hollow sphere, capacitor plates, electric dipole; eld, Millikan experiment, Braun tube; electron: Field emissi- nd inhomogeneous field; induction, Faraday cage; ate and spherical capacitor; combination of capacitors; me- ment and orientation polarisation, microscopic image; diel- ctric effect; ocity, conduction mechanisms; ture dependence; Ohm's law; realisations (resistive and non- eshes, nodes); internal resistance of a voltage source, mea- e; galvanic element; thermovoltage; d model, semiconductor; line in liquids and gases; nagnet, field properties, definitions and units; Earth's ma- n. river, swirl; e electric scalar potential; calculation of fields, examples, nt balance, Lorentz force, right-hand rule, electric motor; di- en filters, Hall effect; electron: e / m determination; on matter, relative permeability, susceptibility; para-, dia-, naviour at interfaces; e, flux change, eddy electric field, Waltenhofen's pendulum;

Bachelor's with 1 major Nanostructure Technology	JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-	page 80 / 150
(2015)	ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015	

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

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

Intended learning outcomes

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

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

V (4) + Ü (2)

Module taught in: Ü: German or English

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

written examination (approx. 120 minutes)

Language of assessment: German and/or English

Allocation of places

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Additional information

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

Workload

240 h

Teaching cycle

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

§ 53 l Nr. 1 a)

§ 77 | Nr. 1 a)

Module appears in

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Module	e title				Abbreviation
Introdu	uction t	o Solid State Physics		11-E-F-152-m01	
Module	e coord	inator		Module offered by	
Manag	ing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	ind Astronomy
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
8	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	Its				
Somme deman 2. Crys tice de tronic p 3. The theory: 4. Strue electro 5. lattic branch examp 6. Ther therma 7. Elect strongl on	 The free-electron gas (FEG), free electrons; density of states; Pauli principle; Fermi-Dirac statistics; spec. heat, Sommerfeld coefficient; electrons in fields: Drude-Lorentz-Sommerfeld; electrical and thermal conductivity, Wie- demann-Franz law; Hall effect; limitations of the model Crystal structure, periodic lattice; types of lattices; Bravais lattice; Miller indices; simple crystal structures; lat- tice defects; polycrystals; amorphous solids; group theoretical approaches, the importance of symmetry for elec- tronic properties The reciprocal lattice (RG), motivation: Diffraction; Bragg condition; definition; Brillouin zones; diffraction theory: Scattering; Ewald construction; Bragg equation; Laue's equation; structure and form factor Structure determination, probes: X-ray, electron, neutron; methods: Laue, Debye-Scherrer, rotating crystal; electron diffraction, LEED lattice vibrations (phonons), equations of motion; dispersion; group velocity; diatomic base: optical, acoustic branch; quantisation: Phonon momentum; optical properties in the infrared; dielectric function (Lorentz model); examples of dispersion curves (occ. Kramers-Kronig), measurement methods Thermal properties of insulators, Einstein and Debye model; phonon density of states; anharmonicity and thermal expansion; thermal conductivity; Umklapp processes; crystal defects Electrons in a periodic potential, Bloch theorem; band structure; approximation of nearly free electrons (NFE); strongly bound electrons (tight binding, LCAO); examples of band structures, Fermi surfaces, spin-orbit interacti- 				
Intend	ed lear	ning outcomes			
dynam ture of Solid-S autono	The students understand the basic contexts and principles of Solid-State Physics (bonding and structure, lattice dynamics, thermal properties, principles of electronic properties (free electron gas)). They understand the structure of solids and know the experimental methods and theoretical models for the description of phenomena of Solid-State Physics. They are able to apply mathematical methods to the formulation of physical contexts and autonomously apply their knowledge to the solution of mathematical-physical tasks.				
		, number of weekly conta	ct hours, language –	- if other than Germa	in)
V (4) + Module	• • •	t in: Ü: German or Englisl	1		
		sessment (type, scope, la ion on whether module c			tion offered — if not every seme-
		nation (approx. 120 minu ssessment: German and	-		
Allocat	ion of	places			
Additio	onal inf	ormation			
Worklo	ad				
240 h					
-40 11					

Teaching cycle

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

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Module appears in

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

Module title				Abbreviation		
Electro	nic Circ	uits			11-EL-152-m01	
Module	e coord	nator		Module offered by		
Manag	naging Director of the Institute of Applied Physics			Faculty of Physics a	nd Astronomy	
ECTS	î	d of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 seme	ster	undergraduate				
Conten	Contents					
coils ar	nd diod	es) and active compon	and circuits. Analogous ents (bipolar and field 10S circuits. Microcont	-effect transistors, op		
Intende	ed learr	ing outcomes				
The stu circuit			practical setup of elect	ronic circuits from th	e field of analogous	and digital
Course	s (type,	number of weekly con	tact hours, language –	- if other than Germa	n)	
V (3) + Module		t in: German or English				
			language — if other th can be chosen to earn		tion offered — if not	every seme-
e) pres If a writ stead t of asse nation Langua	entatio tten exa ake the ssment date at ge of a	form of an oral examin	utes). as method of assessm nation of one candidate er must inform student d/or English	e each or an oral exa	mination in groups.	If the method
Allocat	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
180 h						
Teachi	ng cycl	9				
Referre	d to in	LPOI (examination re-	gulations for teaching-	degree programmes)		
Module	e appea	rs in				
Bachel	or's deg		icture Technology (201	5)		
Bachel	or's deg	gree (1 major, 1 minor) gree (1 major) Physics (gree (1 major) Nonastr	2020)	-)		
	-	gree (1 major) Nanostru gree (1 major, 1 minor)	Icture Technology (202 Physics (Minor, 2020)	0)		
		or Nanostructure Technology	•	generated 18-Apr-2025 • exa	m. reg. da-	page 85 / 150
(2015)				or (180 ECTS) Nanostrukturter		Page 037 130



Bachelor's degree (1 major) Quantum Technology (2021) exchange program Physics (2023)

Module					Abbreviation
Classic	al Phys	sics 1 (Mechanics)			11-E-M-152-m01
AA		•			
Module				Module offered by	
		ector of the Institute o	i	Faculty of Physics	and Astronomy
ECTS		od of grading	Only after succ. c	ompl. of module(s)	
8	nume	rical grade			
Duratio	on	Module level	Other prerequisit	es	
1 seme	ster	undergraduate	Admission prerec	uisite to assessment:	completion of exercises (approx.
			13 exercise sheet	s per semester). Stude	ents who successfully completed
			approx. 50% of ex	kercises will qualify fo	r admission to assessment. The
			lecturer will inform	n students about the	respective details at the beginning
			of the semester.		
Conten	ts				
		Physical quantities n	refactors derived qua	ntitios dimonsional a	nalysis, time / length / mass (de-
			SI), importance of me		naiysis, time / tengtii / mass (de-
					Uniform and constant accelerated
			r motion in polar coord		
					the pendulum, forces on an ato-
			friction. Preparation	of the equations of mo	otion and solutions;
•		nergy: (Kinetic) perfo			
				d momentum conserva	ation, surges in centre of mass
		ystem, rocket equation		ial material energy (leve unight scale field strongth
		of gravity (general rel		iai, potential energy;	law, weight scale, field strength
				torque rotational e	nergy, moment of inertia, analo-
					r), escape velocities, trajectories
-		potential;		,,,	,,,
			rence systems, appare	ent forces, Foucault pe	endulum, Coriolis force, centrifu-
gal for					
					nelson interferometer, Einstein's
•	ates, pr	oblem of simultaneity	/, Lorentz transformati	on, time dilation and	length contraction, relativistic im-
pulse;		Dete			
-	-		-		nd -ellipsoid, principal axes and
		th as a spinning top;	le of the elasticity tens	sol, physics of the bik	e; gyroscope: Precession and nu-
			ion, stick-slip motion.	rolling friction, visco	us friction, laminar flow, eddy for-
mation		alle and dynamic me			
		Representation by me	eans of complex e-fun	ction, equation of mot	ion (DGL) on forces, torque and
			-	-	ılum, physical pendulum, dampec
	-		, aperiodic limit), force		
-	•	_	and eigenfunctions,	double pendulum, dei	terministic vs. chaotic motion,
		namics and chaos;		and the second	
			_		inciple of superposition, reflection
relatior	•	iu cioseu enu, speed	or sound; interference	, poppier enect; phas	se and group velocity, dispersion
		ormation of solid bod	ies: Elastic modulus,	general Hooke's law	elastic waves:
					gle, capillary forces, steady flows,
	-	•			essure, compressibility and com-
pressiv		-		· •	· · ·
					equipartition theorem, Brownian
motion	. collisi	on cross section, me	an froo nath diffusion	and acmosis dagraa	s of froodom sposifis hoot

Intended learning outcomes

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

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

V (4) + Ü (2)

Module taught in: Ü: German or English

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

written examination (approx. 120 minutes)

Language of assessment: German and/or English

Allocation of places

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Additional information

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

Workload

240 h

Teaching cycle

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

§ 53 | Nr. 1 a)

§ 77 | Nr. 1 a)

Module appears in

module appears in					
Bachelor's degree (1 major) Physics	(2015)				
Bachelor's degree (1 major) Nanostr	ucture Technology (2015)				
Bachelor's degree (1 major) Mathem	atical Physics (2015)				
Bachelor's degree (1 major, 1 minor)	Physics (Minor, 2015)				
First state examination for the teach	ing degree Grundschule Physics (2015)				
First state examination for the teach	ing degree Realschule Physics (2015)				
First state examination for the teach	ing degree Gymnasium Physics (2015)				
First state examination for the teach	ing degree Mittelschule Physics (2015)				
Bachelor's degree (1 major) Mathem	atical Physics (2016)				
First state examination for the teach	ing degree Grundschule Physics (2018)				
First state examination for the teach	ing degree Realschule Physics (2018)				
First state examination for the teach	ing degree Gymnasium Physics (2018)				
First state examination for the teach	ing degree Mittelschule Physics (2018)				
Bachelor's degree (1 major) Physics	(2020)				
Bachelor's degree (1 major) Nanostr	ucture Technology (2020)				
Bachelor's degree (1 major) Mathem	Bachelor's degree (1 major) Mathematical Physics (2020)				
Bachelor's degree (1 major, 1 minor)	Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)				
First state examination for the teaching degree Grundschule Physics (2020)					
First state examination for the teach	First state examination for the teaching degree Gymnasium Physics (2020)				
First state examination for the teach	ing degree Realschule Physics (2020)				
Bachelor's with 1 major Nanostructure Technology	JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-	page 88 / 150			
(2015)	ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015				

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

Module title				Abbreviation	
Principles of Energy Technologies 11-ENT-152-mo1					
Module coordinator				Module offered by	
		ctor of the Institute of Ap		Faculty of Physics a	nd Astronomy
ECTS	· · · · · · · · · · · · · · · · · · ·	d of grading	Only after succ. com	pl. of module(s)	
6	r	ical grade			
Duratio		Module level	Other prerequisites		
1 seme	I	graduate			
Contents Physical principles of energy conservation and energy conversion, energy transport and energy storage as well as renewable resources of energy. We also discuss aspects of optimising materials (e.g. nanostructured insula- ting materials, selective layers, highly activated carbons). The course is especially suitable for teaching degree students. Energy conservation via thermal insulation. Thermodynamic energy efficiency. Fossil fired energy con- verters. Nuclear power plants. Hydroelectricity. Wind turbines. Photovoltaics. Solar thermal: Heat. Solar thermal: Electricity. Biomass. Geothermal energy. Energy storage. Energy transport					
The stu	dents k				pecially energy conversion, trans-
					and are able to compare them.
V (3) +		number of weekly conta	ct nours, language –	- If other than Germa	n)
	.,	in: German or English			
		essment (type, scope, la on on whether module ca			tion offered — if not every seme-
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: Once a year, winter semester 					
Allocat	ion of p	laces			
Additio	nal info	ormation			
180 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
§ 22 § 22 § 22	Nr. 2 f)				
Module	e appea	rs in			
Bachel	or's deg	gree (1 major) Physics (20	015)		

UNIVERSITÄT WÜRZBURG

Bachelor's degree (1 major) Nanostructure Technology (2015) First state examination for the teaching degree Grundschule Physics (2015) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2015) First state examination for the teaching degree Realschule Physics (2015) First state examination for the teaching degree Gymnasium Physics (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2015) First state examination for the teaching degree Mittelschule Physics (2015) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2015) Master's degree (1 major) Functional Materials (2016) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2018) First state examination for the teaching degree Realschule Physics (2018) First state examination for the teaching degree Gymnasium Physics (2018) First state examination for the teaching degree Mittelschule Physics (2018) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2018) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2018) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2020) First state examination for the teaching degree Grundschule Physics (2020) First state examination for the teaching degree Gymnasium Physics (2020) First state examination for the teaching degree Realschule Physics (2020) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Physics (2020) Bachelor's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Functional Materials (2022) exchange program Physics (2023) Master's degree (1 major) Functional Materials (2025)

tical path, light in matter, polarization, Geometrical Optics, Optical instruments, wave optics, interference, th	Module title Abbreviation					Abbreviation	
Module coordinator Module offered by Managing Director of the Institute of Applied Physics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) 5 numerical grade Duration Module level Other prerequisites 1 semester undergraduate Contemts Exercises in Optics accordingto the content of 11-E-OAV. Among others Basic concepts, Fermat's principle, optical path, light in matter, polarization, Geometrical Optics, Optical instruments, wave optics, interference, thi films, interferometers, Fraunhofer diffraction optical grating, Fresnel diffraction, holography, wave packets, we quation and Schrödinger equation, quantum structure of nature, etc. Intended learning outcomes The students understand the basic principles and contexts of radiation, wave and quantum optics. They are a to apply mathematical enbods to the formulation of physical contexts and autonomously apply their knowle to apply mathematical enbods to the formulation of physical contexts and autonomously apply their knowle to the solution of mathematical-physical tasks. Courses (type, number of weekly contact hours, language — if other than German) 0 (2) Module taught in: Ü: German or English Method of assessment: German and/or English Atlotional information	Optics and Waves - Exercises					11-E-OA-152-m01	
Managing Director of the institute of Applied Physics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) 5 numerical grade Duration Module level Other prerequisites 1 semester undergraduate Contents Exercises in Optics accordingto the content of 11-E-OAV. Among others Basic concepts, Fermat's principle, op tical path, light in matter, polarization, Geometrical Optics, Optical instruments, wave optics, interference, th films, interferometers, fraunhofer diffraction optical grating, Fresnel diffraction, holography, wave packets, we equation and Schrödinger equation, quantum structure of nature, etc. Intended learning outcomes The students understand the basic principles and contexts of radiation, wave and quantum optics. They are a to apply mathematical methods to the formulation of physical contexts and autonomously apply their knowle to the solution of mathematical-physical tasks. Courses (type, number of weekly contact hours, language – if other than German) 0 (2) Module taught in: Ü: German or English Method of passessment (type, scope, language – if other than German, examination offered – if not every ser ster, information Method of places </th <th colspan="3">Modulo coordinator</th> <th></th> <th>Module offered by</th> <th></th>	Modulo coordinator				Module offered by		
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Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020)			-	- ,			
Bachelor's degree (1 major) Nanostructure Technology (2020)				-	Physics (2015)		
		-			0)		
		-			0)		
exchange program Physics (2023)		-		2021)			

Module title				Abbreviation	
Optics and Quantum Physics					11-E-OAV-152-m01
Module	e coord	inator		Module offered by	
Managi	ng Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	and Astronomy
ECTS	Metho	od of grading	Only after succ. compl. of module(s)		
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
2 seme	ster	undergraduate			
Contents					
A. optics and quanta					

Light (linked to 11-E-E): basic concepts, the speed of light, Huygens-Fresnel principle: reflection, refraction.
 Light in matter: propagation velocity in the medium; dispersion, complex and frequency-dependent dielectric constant; absorption, Kramers-Kronig relation, interfaces, Fresnel equations, polarization, generation by absorption, birefringence, optical activity (dipole)

3. Geometrical optics: basic concepts, Fermat's principle, optical path, planar interfaces, Snell's law, total reflection, optical tunneling, evanescent waves, prism; normal and anomalous dispersion, curved interfaces, thin and thick lenses, lens systems, lens grinder formula, aberrations, imaging errors (spherical & chromatic aberration, astigmatism, coma, distortion, correction approaches).

4. Optical instruments: characteristics; camera, eye, magnifying glass, microscope, telescope types, bundle beam vs. image construction (electron lenses, electron microscope), confocal microscopy.

5. Wave optics: spatial and temporal coherence, Young's double slit experiment, interference pattern (intensity profile), thin films, parallel layers, wedge-shaped layers, phase shift, Newton rings, interferometer (Michelson, Mach-Zender, Fabry-Perot).

6. Diffraction in the far field: Fraunhofer diffraction, , single slit, intensity distribution, apertures, resolving power, Rayleigh & Abbé criterion, Fourier optics, optical grating, n-fold slit, intensity distribution, grating spectrometer and resolution, diffraction off atomic lattices, convolution theorem.

7. Diffraction in the near field: Fresnel, near-field diffraction at circular apertures/disks, Fresnel zone plate, near-field microscopy, holography, Huygens-Fresnel concept; white light hologram.

8. Failure of classical physics I - from light wave to photon: black body radiation and Planck's quantum hypothesis; photoelectric effect and Einstein's explanation, Compton effect, light as a particle, wave-particle duality, , quantum structure of nature

9. Failure of classical physics II - particles as waves: de Broglie's matter wave concept; diffraction of particle waves (Davisson-Germer-experiment, double slit interference).

10. Wave mechanics: wave packets, phase and group velocity (recap of 11-EM), uncertainty principle, Nyquist-Shannon theorem, wave function as probability amplitude, probability of residence, measurement process in quantum mechanics (double-slit experiment & which-way information, collapse of the wave function, Schrödinger's cat).

11. Mathematical concepts of quantum mechanics: Schrödinger equation as wave equation, conceptual comparison to wave optics, free particle and particles in a potential, time-independent Schrödinger equation as eigenvalue equation, simple examples in 1D (potential step, potential barrier and tunnel effect, box potential and energy quantization, harmonic oscillator), box potential in higher dimensions and degeneracy, formal theory of QM (states, operators, observables).

B. atomic and molecular physics

 Structure of atoms: experimental evidence for the existence of atoms, size of the atom, charges and masses in the atom, isotopes, internal structure, Rutherford experiment, instability of the "classical" Rutherford atom
 Quantum mechanical foundations of atomic physics (short recap of part A.): light as particle beam, particles as waves, wave functions and probability interpretation, uncertainty relation and stability of the atom, energy quantization in the atom, Franck-Hertz experiment, atomic spectra, Bohr's model and its limitations, non-relativistic Schrödinger equation.

Bachelor's with 1 major Nanostructure Technolog	sy
(2015)	

UNIVERSITÄT WÜRZBURG

3. The non-relativistic hydrogen atom: hydrogen and hydrogen-like atoms, central-symmetric potential and angular momentum in QM, Schrödinger equation of the H-atom, atomic orbitals, radial and angular wave functions, quantum numbers, energy eigenvalues.

4. Atoms in external fields: orbital magnetic dipole moment, gyromagnetic ratio, magentic fields: normal Zeeman effect, electrical fields: Stark effect.

5. Fine and hyperfine structure: electronic spin and magnetic spin moment, Stern-Gerlach experiment, Einstein-de Haas effect, glimpse of the Dirac equation (spin as relativistic phenomenon and existence of antimatter), electron spin resonance (ESR), spin-orbit coupling, relativistic fine structure, Lamb shift (quantum electrodynamics), nuclear spin and hyperfine structure.

6. Multielectron atoms: helium atom as simplest example, indistinguishability of identical particles, (anti)symmetry with respect to particle exchange, fermions and bosons, relationship to spin, Pauli principle, orbital and spin wave function of two-particle systems (spin singlets and triplets), LS- and jj-coupling, periodic table of the elements, Aufbau principles and Hund's rules.

7. Light-matter interaction: time-dependent perturbation theory (Fermi's Golden Rule) and optical transitions, matrix elements and dipole approximation, selection rules and symmetry, line broadening (lifetime, Doppler effect, collision broadening), atomic spectroscopy.

8. LASER: elementary optical processes (absorption, spontaneous and stimulated emission), stimulated emission as light amplification, Einstein's rate equations, thermal equilibrium, non-equilibrium character of a laser: rate equations, population inversion, and laser condition, principle structure of a laser, optical pumping, 2-, 3- and 4-level lasers, examples (ruby laser, He-Ne laser, semiconductor laser).

9. Inner-shell excitations and x-ray physics: generation of x-ray radiation, Bremsstrahlung and characteristic spectrum, x-ray emission for elemental analysis (EDX), x-ray absorption and contrast formation in x-ray images, x-ray photoemission, non-radiative Auger processes, synchrotron radiation, application examples.

10. Molecules and chemical bonding: molecular hydrogen ion (H2+) as simplest example: rigid molecule approximation and LCAO approach, bonding and antibonding molecular orbitals, hydrogen molecule (H2): molecular orbital vs. Heitler-London approximation, biatomic heteronuclear molecules: covalent vs. ionic bonding, van der Waals bonds and Lennard-Jones potential, (time allowing: conjugated molecules).

11. Molecule rotations and vibrations: Born-Oppenheimer approximation, rigid rotator (symmetric and unsymmetrical molecules), centrifugal splitting/expansion, molecule as (an)harmonic oscillator, Morse potential, normal vibrational modes, vibrational-rotational interaction.

12. Molecular spectroscopy: transition matrix elements, vibrational spectroscopy: infrared spectroscopy and Raman effect, vibrational-rotational transitions: Fortrat diagram, electronic transitions: Franck-Condon principle.

Intended learning outcomes

The students understand the basic principles and contexts of radiation, wave and quantum optics and quantum phenomena as well as Atomic and Molecular Physics. They understand the theoretical concepts and know the structure and application of important optical instruments and measuring methods. They understand the ideas and concepts of quantum theory and Astrophysics and the relevant experiments to observe and measure quantum phenomena. They are able to discuss their knowledge and to integrate it into a bigger picture.

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

V (4) + V (4)

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

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

Allocation of places

Additional information

Workload

180 h

Teaching cycle

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

Module appears in

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

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

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

Bachelor's degree (1 major) Nanostructure Technology (2020)

Bachelor's degree (1 major) Quantum Technology (2021)

exchange program Physics (2023)

Module title			Abbreviation			
Fit for Industry					11-FFI-152-m01	
Module coordinator				Module offered by		
Managi	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy	
ECTS	1	od of grading	Only after succ. con	npl. of module(s)		
3	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
environ	iment.		come opportunities.		ies. Orientation in the industrial . Marketing, corporate strategy	
Intende	ed lear	ning outcomes				
		know about the requirem on their knowledge.	ents of jobs in the in	dustry and are able t	o make decisions for their own	
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
V (1) + I Module		t in: German or English				
		sessment (type, scope, la ion on whether module ca			tion offered — if not every seme-	
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: Once a year, summer semester 						
Allocat	ion of _l	olaces				
Additio	nal inf	ormation				
Workload						
90 h						
Teaching cycle						
Referre	d to in	LPOI (examination regu	lations for teaching-o	legree programmes)		
Module	e appea	ars in				
Bachel	or's de	gree (1 major) Physics (20	015)			
	Bachelor's degree (1 major) Nanostructure Technology (2015)					

Module title	Abbreviation				
Semiconductor Lasers and Photonics 11-HLF-152-mo1					
Module coordinator		Module offered by			
Managing Director of the Institute of A	Managing Director of the Institute of Applied Physics Face		nd Astronomy		
ECTS Method of grading	Only after succ. compl. of module(s)				
6 numerical grade					
Duration Module level	Other prerequisites				
1 semester graduate					
Contents					
This lecture discusses the principles of laser physics, based on the example of semiconductor lasers, and cur- rent developments regarding components. The principles of lasers are described on the basis of a general laser model, which will then be extended to special aspects of semiconductor lasers. Basic concepts such as thres- hold condition, characteristic curve and laser efficiency are derived from coupled rate equations for charge car- riers and photons. Other topics of the lecture are optical processes in semiconductors, layer and ridge wavegui- des, laser resonators, mode selection, dynamic properties as well as technology for the generation of semicon- ductor lasers. The lecture closes with current topics of laser research such as quantum dot lasers, quantum cas-					
cade lasers, terahertz lasers or high-p Intended learning outcomes					
The students have advanced knowled knowled knowledge to modern questions and h					
Courses (type, number of weekly cont	act hours, language –	- if other than Germa	n)		
V (3) + R (1) Module taught in: German or English					
Method of assessment (type, scope, l	anguage — if other th	an German, examina	tion offered — if not every seme-		
ster, information on whether module of	an be chosen to earn	a bonus)			
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: Once a year, summer semester 					
Allocation of places					
Additional information					
 Workload					
180 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelor's degree (1 major) Physics (2	015)				

Bachelor's degree (1 major) Nanostructure Technology (2015) Master's degree (1 major) Functional Materials (2016) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Functional Materials (2022) exchange program Physics (2023) Master's degree (1 major) Functional Materials (2025)

Module title				Abbreviation		
Fundamentals of Semiconductor Physics 11-HLP-152-m01						
Module coordinator			Module offered by			
	Director of the Institute of		Faculty of Physics a	nd Astronomy		
	lethod of grading	Only after succ. con	npl. of module(s)			
I	umerical grade					
Duration 1 semeste	Module level er undergraduate	Other prerequisites				
Contents 1. Symmetry properties 2. Crystal formation and electronic band structure 3. Optical excitations and their coupling effects						
5. Temper	n-phonon coupling rature-dependent transport magnetic semiconductors	properties				
Intended	learning outcomes					
	nts are familiar with the pri rs and know their physical				re of semi-	
Courses (type, number of weekly cor	tact hours, language –	- if other than Germa	n)		
V (3) + R (Module ta	1) aught in: German or English					
	f assessment (type, scope, mation on whether module			tion offered — if not	every seme-	
 b) oral exa c) oral exa d) project e) present lf a written stead take of assessination da Language 	 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: Once a year, summer semester 					
Allocatior	n of places					
Additiona	l information					
Workload						
180 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Physics (2020)						
Bachelor's with (2015)	n 1 major Nanostructure Technology	-	• generated 18-Apr-2025 • exa or (180 ECTS) Nanostrukturte	-	page 99 / 150	



Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021) exchange program Physics (2023)

<u> </u>	e title				Abbreviation	
Crystal Growth, thin Layers and Lithography					11-KDS-152-m01	
Module coordinator				Module offered by		
			of Applied Physics			
Managing Director of the Institute of Applied PhysicsFaculty of Physics and AstronomyECTSMethod of gradingOnly after succ. compl. of module(s)						
6	i	rical grade				
 Duratio	<u> </u>	Module level	Other prerequisit	65		
1 seme:		undergraduate				
Conten						
		, thin films, lithograp	ohy.			
		ing outcomes	<u> </u>			
laborat	ory. The		ical knowledge of the p		ds to control crystal growth in the nation of thin layers and know	
Course	s (type,	number of weekly c	ontact hours, language	e — if other than Germ	an)	
V (3) + I	• •					
		t in: German or Engli				
			e, language — if other Ile can be chosen to ea		ation offered — if not every seme-	
If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English Assessment offered: Once a year, winter semester						
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of asse nation Langua Assess	essment date at age of a	form of an oral exan is changed, the lect the latest. ssessment: German ffered: Once a year, y	nination of one candida turer must inform stude and/or English	ate each or an oral exa	amination in groups. If the method	
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of asse nation Langua Assess Allocat	essment date at age of as ment of ion of p onal info	form of an oral exam is changed, the lect the latest. ssessment: German ffered: Once a year, y laces	nination of one candida turer must inform stude and/or English	ate each or an oral exa	amination in groups. If the method	
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of asse nation o Langua Assess Allocat Additio Worklo 180 h	essment date at age of as ment of ion of p onal info	form of an oral exam is changed, the lect the latest. ssessment: German ffered: Once a year, y places	nination of one candida turer must inform stude and/or English	ate each or an oral exa	amination in groups. If the method	
of asse nation o Langua Assess Allocat Additio Worklo 180 h	assment date at age of a ment of ion of p mal info	form of an oral exam is changed, the lect the latest. ssessment: German ffered: Once a year, y places	nination of one candida turer must inform stude and/or English	ate each or an oral exa	amination in groups. If the method	
of asse nation o Langua Assess Allocat Additio Worklo 180 h Teachir	essment date at ige of a ment of ion of p onal info ad	form of an oral exam is changed, the lect the latest. ssessment: German ffered: Once a year, v places	nination of one candida turer must inform stude and/or English	ate each or an oral exa ents about this by four	amination in groups. If the method weeks prior to the original exami-	
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of asse nation of Langua Assessi Allocat Additio Worklo 180 h Teachir Referre Bachelo	essment date at age of a ment of ion of p mal info ad ad ed to in e appea or's deg	form of an oral examination is changed, the lect the latest. ssessment: German ffered: Once a year, wo places ormation e LPO I (examination rs in gree (1 major) Physic	nination of one candida turer must inform stude and/or English winter semester 	ate each or an oral exa ents about this by four g-degree programmes	amination in groups. If the method weeks prior to the original exami	
of asse nation of Langua Assessi Allocat Additio Worklo 180 h Teachin Referre Bachelo Bachelo	essment date at age of a ment of ion of p onal info ad ad ad ad ad ad ad ad ad ad ad ad ad	form of an oral examination is changed, the lect the latest. ssessment: German ffered: Once a year, wo places ormation e LPO I (examination rs in gree (1 major) Physic	nination of one candida turer must inform stude and/or English winter semester regulations for teaching s (2015) tructure Technology (20	ate each or an oral exa ents about this by four g-degree programmes	amination in groups. If the method weeks prior to the original exami	
of asse nation of Langua Assess Allocat Additio Worklo 180 h Teachin Referre Bachelo Bachelo Bachelo Bachelo	essment date at age of a ment of ion of p onal info ad ad ad ad ad ad ad ad ad ad ad ad ad	form of an oral examination is changed, the lect the latest. ssessment: German ffered: Once a year, we blaces ormation commati	nination of one candida turer must inform stude and/or English winter semester regulations for teaching s (2015) tructure Technology (20 s (2020) tructure Technology (20	ate each or an oral exa ents about this by four g-degree programmes 015)	amination in groups. If the method weeks prior to the original exami	
of asse nation of Langua Assessi Allocat Morklo 180 h Teachin Referre Bachelo Bachelo Bachelo Bachelo	essment date at age of a ment of ion of p mal info ad ad ad ad ad ad ad ad ad ad ad ad ad	form of an oral examination is changed, the lect the latest. ssessment: German ffered: Once a year, we places ormation commati	nination of one candida turer must inform stude and/or English winter semester regulations for teaching s (2015) tructure Technology (20 s (2020)	ate each or an oral exa ents about this by four g-degree programmes 015)	amination in groups. If the method weeks prior to the original exami	

Module title				Abbreviation		
Princip	Principles of Pattern Classification 11-KVM-152-mo1					
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
3	nume	rical grade				
Duratio		Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
terns. 1 More a	These p nd mor	atterns are often classifie	ed and analysed by o are adopted to take o	bservers, e.g. by a d on these tasks and cl	ents often contain recurring pat- octor when analysing an ECG. assify patterns. The lecture will .imum likelihood".	
Intend	ed lear	ning outcomes				
classify	ying pa				gnition. They know methods of esses. They are able to apply	
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
V (2) Module	e taugh	t in: German or English				
			nguage — if other th	an German, examina	tion offered — if not every seme-	
		on on whether module ca			,	
b) oral c) oral d) proje	examir examin ect repo	mination (approx. 90 to 1 nation of one candidate e ation in groups (groups c ort (approx. 8 to 10 pages n/talk (approx. 30 minute	ach (approx. 30 minu of 2, approx. 30 minu s) or	-	r	
If a write stead to of asset nation Langua	tten exa ake the essmen date at age of a	amination was chosen as form of an oral examinat	method of assessme tion of one candidate must inform student /or English	e each or an oral exa	nged and assessment may in- mination in groups. If the method weeks prior to the original exami-	
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Workload						
90 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in					
		gree (1 major) Physics (20				
Bachel	or's de	gree (1 major) Nanostruct	ure Technology (201	5)		

Module	title		Abbreviation			
Laboratory and Measurement Technology in Biophysics			11-LMB-152-mo1			
Module coordinator			Module offered by			
Managing Director of the Institute of Applied Physics			Faculty of Physics and Astronomy			
ECTS Method of grading Only after succ. compl. of module(s)						
6	numerical grade					
Duratio		Other prerequisi	tes			
1 semes	ster graduate					
Content	ts					
physica measur	al procedures for the exa	mination and manipulati sors, methods of single-p	cellular biology as well as the physical principles of bio on of biological systems. The main topics are optical particle detection, special microscoping techniques an			
Intende	ed learning outcomes					
sical pr	ocedures for the examin ing techniques and their	ation and manipulation o	lar biology as well as the physical principles of biophy of biological systems. They have knowledge of optical le to apply techniques of structure elucidation to simp			
Courses	s (type, number of weekl	y contact hours, languag	e — if other than German)			
V (3) + F Module	R (1) e taught in: German or En	ıglish				
		cope, language — if other odule can be chosen to ea	r than German, examination offered — if not every sem arn a bonus)			
 b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English 						
	ment offered: Once a yea ion of places					
	<u> </u>					
Additio	nal information					
 Workloa	ad					
180 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
 Module appears in						
Bachelo Bachelo	or's degree (1 major) Phy or's degree (1 major) Nar					
Master'	Bachelor's degree (1 major) Nanostructure Technology (2015) Master's degree (1 major) Functional Materials (2016)					

Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Functional Materials (2022) exchange program Physics (2023) Master's degree (1 major) Functional Materials (2025)

Module title			Abbreviation			
Laboratory and Measurement Technology 11-LMT-152-mo1						
Module	e coord	inator		Module offered by		
Manag		ector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS		od of grading	Only after succ. con	npl. of module(s)		
6	L	rical grade				
Duratio		Module level	Other prerequisites	i		
1 seme		undergraduate				
	iction to		l measuring methods o roscopic methods and			y and cryoge-
		ning outcomes				
The stu	idents l n techn	nave competencies in t	he field of electronic a cryogenics, light source			
Course	s (type	, number of weekly cor	itact hours, language –	- if other than Germa	n)	
V (3) + Module		t in: German or English				
			language — if other th can be chosen to earn		tion offered — if not	every seme-
d) proje e) pres If a writ stead t of asse nation Langua	ect repo entatio tten exa ake the essmen date at age of a	ort (approx. 8 to 10 pag n/talk (approx. 30 min amination was chosen e form of an oral examin	utes). as method of assessme nation of one candidate rer must inform student nd/or English	ent, this may be char e each or an oral exa	nged and assessmer mination in groups.	If the method
Allocat		•				
Additio	onal info	ormation				
Worklo	ad					
180 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination re	gulations for teaching-	degree programmes)		
Module appears in						
Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) Master's degree (1 major) Functional Materials (2016) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's with 1 major Nanostructure Technology (2020)						
(2015)			-	or (180 ECTS) Nanostrukturte	-	Page 103 / 130

Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) Bachelor's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Functional Materials (2022) exchange program Physics (2023) Master's degree (1 major) Functional Materials (2025)

Module title				Abbreviation
Introduction to Labview 11-LVW-152-mo1				
Module coordinator			Module offered by	
Managing Director of the Institute of Applied Physics			Faculty of Physics a	nd Astronomy
ECTS Method of grading Only after succ. compl. of module(s)				
	merical grade			-
Duration	Module level	Other prerequisites		
1 semester	r graduate			
Contents The module comprises basic and advanced courses. The basic course "NI LabVIEW Basic 1" is the first level of each LabVIEW learning phase. LabVIEW Basic provides a systematic introduction to the functions and application of fields of the development environment of LabVIEW. The students become acquainted with dataflow programming and with common LabVIEW architectures. They learn to develop LabVIEW applications for various application of fields, from assessment and measurement applications up to data collection, device control, data recording and measurement analysis. In the advanced course "NI LabVIEW Core 2", the students learn to develop comprehensive standalone applications, including the graphical development environment LabVIEW. The course builds upon LabVIEW Basic 1 and provides an introduction to the most common development technologies, in order to enable the students to successfully implement and distribute LabVIEW applications for different application fields. Course topics include techniques and procedures for the optimisation of application performance, e.g. through an optimised reuse of existing codes, usage of file I/O functions, principles of data management, event computing and methods of error handling. After finishing the course, the students have the ability to apply Lab-VIEW functions according to individual requirements, which enables a fast and productive application development.				
	ype, number of weekly conta	ct hours, language —	- if other than Germa	n)
V (1) + R (3 Module tai) ught in: German or English			
	assessment (type, scope, la nation on whether module ca			tion offered — if not every seme-
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: Once a year, winter semester 				
Additional	information			
 Workload				
180 h				

Teaching cycle

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

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Module appears in

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

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

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

Bachelor's degree (1 major) Nanostructure Technology (2020)

Bachelor's degree (1 major) Quantum Technology (2021)

exchange program Physics (2023)

Module	e title				Abbreviation	
		3 for Students of Physi	cs and related Discipli	nes (Differential	11-M-D-152-m01	
Equation	ons)					
Modul	e coord	inator		Module offered by		
	ing Dire trophys	ector of the Institute of ⁻ sics	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS	1	od of grading	Only after succ. cor	npl. of module(s)		
8	nume	rical grade		•		
Duratio	on	Module level	Other prerequisites	i		
1 seme	ster	undergraduate				
Conten	Its					
Ordina Fundar	ry diffe nentals	nary differential equations and so of function theory.		equations.		
1.1 Solu 1.2 Exis 1.3 Sys 1.4 Gre 1.5 Her 2. Func 2.1 Cor 2.2 Difl 2.3 Sin 2.4 Cor 2.5 Lau 2.6 Ana 2.7 gar 2.8 Dif 2.9 Sac	ution m stence a tems o ens fur mitsch ction th nplex fu ferentia gulariti nplex i urent se alytical nma, b ferentia ddle po	ferential equations ethods and uniqueness theore f differential equations action for inhomogeneo e DGL, Legendre DGL eory unctions ition, holomorphic func es in the complex ntegration and the Cauc ries, residual theorem, continuation, meromor eta, hypergeometric fur al equations in the complex int method	us problems tions chy integral theorem Fourier transformatior phic functions, whole actions, sets of Weiers plex, Bessel differentia	functions trasse and Mittag-Le	ffler	
- /		ning outcomes				
The stu on met	ident h hods fo	as basic knowledge of r or ordinary differential e ne required computing t	equations as well as th			
Course	s (type	, number of weekly con	tact hours, language –	- if other than Germa	an)	
V (4) + Module	• •	t in: Ü: German or Engli	sh			
		essment (type, scope, on on whether module			ation offered — if no	ot every seme-
		nation (approx. 120 mir ssessment: German an				
	tion of p	-	,			
			_			
	nal inf	ormation				
Auuitio	mat III					
Worklo	ad					
240 h						
		or Nanostructure Technology		generated 18-Apr-2025 • ex		page 109 / 150

Teaching cycle

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

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Module appears in

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

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

Bachelor's degree (1 major) Functional Materials (2015)

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

Bachelor's degree (1 major) Nanostructure Technology (2020)

Bachelor's degree (1 major) Functional Materials (2021)

Bachelor's degree (1 major) Quantum Technology (2021)

exchange program Physics (2023)

Bachelor's degree (1 major) Functional Materials (2025)

Module title				Abbreviation
Mathematics lysis)	4 for Students of Physics	and related Discipli	nes (Complex Ana-	11-M-F-152-m01
Module coord	inator		Module offered by	
Managing Dire and Astrophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	and Astronomy
ECTS Metho	od of grading	Only after succ. con	npl. of module(s)	
8 nume	rical grade			
Duration	Module level	Other prerequisites	;	
1 semester	undergraduate			
Contents		·		
quantum mec ment of the fo Fundamentals Part I: function 1.1 Linear vect 1.2 Metric, sta 1.3 Linear ope 1.4 Function s 1.5 Linear ope 1.6 Matrix rep 1.8 The Dirac of Part II: differen 2. Partial diffe 2.1 Linear part 2.2 1D and 3D 2.3 Helmholtz	hanics and the represent rmal framework of quant of partial differential eq nal analysis or spaces ndardized spaces	ation as a wave func um mechanics with t uations in physics an gue integral, Hilbert s ce ferent representation	tion generated by ba he so-called bracket nd systems of differe	
•	ning outcomes			
The student h	as basic knowledge of m			ert space mathematics, as well cient in the necessary computing
Courses (type	, number of weekly conta	ict hours, language –	- if other than Germa	an)
V (4) + Ü (2) Module taugh	t in: Ü: German or Englisł	1		
	sessment (type, scope, la on on whether module ca			ation offered — if not every seme-
	nation (approx. 120 minu ssessment: German and,	-		
Allocation of p	olaces			
Additional inf	ormation			
Workload				

240 h

Teaching cycle

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

Module appears in

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

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

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

Bachelor's degree (1 major) Nanostructure Technology (2020)

Bachelor's degree (1 major) Functional Materials (2021)

Bachelor's degree (1 major) Quantum Technology (2021)

exchange program Physics (2023)

Bachelor's degree (1 major) Functional Materials (2025)

Module					Abbreviation	
Mathe	matical	Methods of Physics			11-M-MR-152-m01	
Module	e coord	inator		Module offered by		
		ector of the Institute of T	heoretical Physics	Faculty of Physics a	nd Astronomy	
	trophys					
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	(not) s	successfully completed				
Duratio	on	Module level	Other prerequisites	i		
2 seme	ester	undergraduate				
Conten	Its					
		nathematics and basic c I preparation of the mod				
Intend	ed lear	ning outcomes				
		have knowledge of the p eoretical and Experimen		tics and elementary	calculation method	s which are
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	n)	
• •	• •	V (2) + Ü (1)				
Module	e taugh	t in: German or English				
		essment (type, scope, la on on whether module o			tion offered — if no	t every seme-
		successful completion of	approx. 50% of appr	ox. 13 exercise sheet	s) or	_
		x. 15 minutes)				
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
180 h	-					
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination reg	ulations for teaching-	degree programmes)		
§ 53 N § 77 N						
	e appea	urs in				
		gree (1 major) Physics (2	015)			
		gree (1 major) Nanostruc	-	5)		
		gree (1 major) Mathemat	• -			
		gree (1 major, 1 minor) P	-			
		mination for the teachin				
		mination for the teachin		• -		
		mination for the teachin				
		mination for the teachin		Physics (2015)		
		gree (1 major) Mathemat	•	Dhusics (2019)		
		mination for the teachin				
		mination for the teachin mination for the teachin		•		
		mination for the teachin	,	•		
				•		
ank - 1		or Nanostructure Technology	18.811.5.87** 1	generated 18-Apr-2025 • exa	wa waa da	page 113 / 150

Module	e title				Abbreviation				
	Nanoanalytics 11-NAN-152-mo1								
Module	e coord	inator		Module offered by					
Manag	ing Dire	ector of the Institute of Ap		Faculty of Physics a	ind Astronomy				
ECTS		od of grading	Only after succ. con	npl. of module(s)					
6	6 numerical grade								
	Duration Module level Other prerequisites								
1 seme		graduate							
Conten	lts								
Principles of analytic procedures in the field of nanostructure physics, imaging techniques from a microscopic level up to an atomic level, examination of chemical composition, spectroscopy of electronic properties, usage of X-ray methods Physics and material systems on the nanoscale Scanning probes: Atomic force microscopy. Scanning tunneling microscopy Electron probes: Scanning electron microscope. Transmission electron microscope Secondary ions - mass spectrometry - X-ray methods: Synchrotron spectroscopy. Photoemission. X-ray absorption									
Intend	ed learr	ning outcomes							
The students have basic knowledge of modern research methods for different nanostructures up to an atomic level. They know microscoping procedures that are used in practice in labs and the industry as well as spectroscopic methods for the determination of electronic properties. They are able to evaluate the efficiency of different research methods.									
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)				
V (3) + Module		t in: German or English							
	Method of assessment (type, scope, language — if other than German, examination offered — if not every seme-								
ster, information on whether module can be chosen to earn a bonus)									
 ster, information on whether module can be chosen to earn a bonus) a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: Once a year, winter semester 									
	ion of p	*							
Additio	onal info	ormation							
Worklo	ad								
180 h									
	ng cycl	9							
	0 - 9 - 0								
Referre	ed to in	LPOI (examination regu	lations for teaching-o	degree programmes)					
Modul	e appea	rs in							
		gree (1 major) Physics (20	015)						
Dachel	or 5 ucg								

Bachelor's degree (1 major) Nanostructure Technology (2015) Master's degree (1 major) Functional Materials (2016) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021) exchange program Physics (2023)

Module	e title				Abbreviation
Genera	al Comp	etences for Students of	Nanostructure Techno	ology	11-NASQ5-152-m01
Modul	e coord	inator		Module offered by	
chairp	erson o	f examination committee		Faculty of Physics a	and Astronomy
ECTS	1	od of grading	Only after succ. com		
5		rical grade		1	
Duratio	on	Module level	Other prerequisites		
1 seme	ester	undergraduate	Approval from exam	ination committee r	equired.
Conten	nts				
Genera	al qualif	ications for students of r	anostructure techno	logy.	
Intend	ed lear	ning outcomes			
nology gy and the app	of the l the req plicatio	Bachelor's programme. T Juired understanding of t n areas.	hey have knowledge his topic. They are ab	of a current subdisc le to classify the su	a module of Nanostructure Tech- ipline of nanostructure technolo- bject-specific contexts and know
		, number of weekly conta	ict hours, language –	- if other than Germa	an)
V (2) +	R (2)				
a) writt b) oral c) oral d) proj e) pres If a wri	ten exan examir examin ect repo sentatio tten exa		20 minutes) or ach (approx. 30 minu of 2, approx. 30 minu s) or es) s method of assessme	utes) or tes per candidate) o ent, this may be cha	nged and assessment may in-
of asse nation	essmen date at		must inform student		mination in groups. If the metho weeks prior to the original exami
Allocat	tion of p	olaces			
Additic	onal inf	ormation			
Worklo	bad				
150 h					
	ng cycl				
Teachi		e			
Teachi 		e			
		e LPOI (examination regu	lations for teaching-o	degree programmes))
			lations for teaching-c	degree programmes))
 Referre	ed to in	LPOI (examination regu	lations for teaching-o	degree programmes))
 Referre Module	ed to in e appea	LPOI (examination regu)

Module	e title				Abbreviation
Introdu	ction t	o Nanoscience			11-N-EIN-152-m01
Module	o coord	inator		Module offered by	
		ector of the Institute of Ap	onlied Physics	Faculty of Physics a	and Astronomy
ECTS	1	od of grading	Only after succ. con		
7		rical grade		<u> </u>	
Duratio	n	Module level	Other prerequisites		
2 seme	ester	undergraduate	Admission prerequi 85% of sessions).	site to assessment:	regular attendance (minimum
Conten	ts				
Introdu	iction to	o the principles of produ	cing, characterising a	nd applying nanostr	ructures.
Intende	ed lear	ning outcomes			
		nave knowledge of the fu ructures.	ndamental propertie	s, technologies, cha	racterising methods and functi-
Course	s (type	, number of weekly conta	ict hours, language –	- if other than Germa	in)
V (2) + Module	• •	t in: German or English			
		s essment (type, scope, la on on whether module c			tion offered — if not every seme-
	-	5 minutes) with discussi ssessment: German and		amination (approx. 1	20 minutes)
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
this wil 3 Sente find tha gistrati ly regis sessme	Il be co ence 47 at the s on for a ter for a ent was	nsidered a declaration of ASPO (general academic tudent has obtained the assessment into effect. O an assessment. Students not put into effect will n	f will to seek admission and examination reg qualification for adm only those students the who did not register ot be admitted to the	on to assessment pu ulations). If the mod ission to assessmen at meet the respect for an assessment of respective assessment	n for admission to assessment, ursuant to Section 20 Subsection ule coordinators subsequently nt, they will put the student's re- ive prerequisites can successful- or whose registration for an as- tent. If a student takes an as- sessment will not be considered.
Worklo	ad				
210 h			<u>.</u>		
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	lations for teaching-o	legree programmes)	
Module	e appea	irs in			
Bachel Bachel Bachel	or's de or's de or's de	gree (1 major) Nanostruct gree (1 major) Functional gree (1 major, 1 minor) Ph gree (1 major) Nanostruct	Materials (2015) nysics (Minor, 2015) ture Technology (202		
		gree (1 major, 1 minor) Pł			
Bachel	or's de	gree (1 major) Functional	Materials (2021)		

Module coord Managing Dire the Institute o ECTS Metho 5 numer Duration 1 semester Contents Current questi Intended learr The students h to independer	ectors of the Institute of A f Theoretical Physics and od of grading rical grade Module level undergraduate ons on advanced topics on hing outcomes	Astrophysics Only after succ. con Other prerequisites Admission prerequi 85% of sessions). of nanostructure tech of a specialist field of	site to assessment: I	regular attendance (minimum
Managing Dire the Institute o ECTS Metho 5 numer Duration 1 semester Contents Current questi Intended learr The students H to independer Courses (type,	ectors of the Institute of A f Theoretical Physics and od of grading rical grade Module level undergraduate ons on advanced topics of hing outcomes have in-depth knowledge htly acquire this knowledge	Astrophysics Only after succ. con Other prerequisites Admission prerequi 85% of sessions). of nanostructure tech of a specialist field of	Faculty of Physics a npl. of module(s) site to assessment: nnology.	regular attendance (minimum
the Institute o ECTS Metho 5 numer Duration 1 semester Contents Current questi Intended learr The students h to independer Courses (type,	f Theoretical Physics and od of grading rical grade Module level undergraduate ons on advanced topics of ning outcomes have in-depth knowledge ntly acquire this knowledge	Astrophysics Only after succ. con Other prerequisites Admission prerequi 85% of sessions). of nanostructure tech of a specialist field of	npl. of module(s) site to assessment: i nnology.	regular attendance (minimum
5 numer Duration 1 semester Contents Current questi Intended learr The students H to independer Courses (type,	rical grade Module level undergraduate ons on advanced topics of ning outcomes nave in-depth knowledge ntly acquire this knowledge	 Other prerequisites Admission prerequi 85% of sessions). of nanostructure tech of a specialist field of	site to assessment: I	
Duration 1 semester Contents Current questi Intended learr The students H to independer Courses (type)	Module level undergraduate ons on advanced topics on ning outcomes have in-depth knowledge natly acquire this knowledge	Admission prerequi 85% of sessions). of nanostructure tech of a specialist field o	site to assessment: 1 nnology.	
1 semester Contents Current questi Intended learr The students H to independer Courses (type)	undergraduate ons on advanced topics o ning outcomes nave in-depth knowledge ntly acquire this knowleds	Admission prerequi 85% of sessions). of nanostructure tech of a specialist field o	site to assessment: 1 nnology.	
Contents Current questi Intended learn The students H to independer Courses (type,	ons on advanced topics on ning outcomes nave in-depth knowledge ntly acquire this knowledge	85% of sessions). of nanostructure tech of a specialist field of	nnology.	
Current questi Intended learn The students H to independer Courses (type,	ning outcomes nave in-depth knowledge ntly acquire this knowleds	of a specialist field o		
Intended learn The students I to independer Courses (type,	ning outcomes nave in-depth knowledge ntly acquire this knowleds	of a specialist field o		
The students h to independer Courses (type,	nave in-depth knowledge ntly acquire this knowledg		of advanced nanostr	
The students h to independer Courses (type,	nave in-depth knowledge ntly acquire this knowledg		of advanced nanostr	
	, number of weekly conta		it in an oral present	ucture technology. They are able ation.
		ct hours, language –	- if other than Germa	n)
S (2) Module taugh	t in: German or English			
	essment (type, scope, la on on whether module ca			tion offered — if not every seme-
a) talk (30 to 2	5 minutes) with discussion	on and b) written exa	amination (approx. 1	20 minutes)
Allocation of p	olaces			
Additional info	ormation			
this will be con 3 Sentence 4 A find that the s gistration for a ly register for a sessment was	nsidered a declaration of ASPO (general academic a tudent has obtained the assessment into effect. Of an assessment. Students not put into effect will no	will to seek admission and examination reg qualification for adm nly those students th who did not register of be admitted to the	on to assessment pu ulations). If the mod ission to assessmen nat meet the respecti for an assessment of respective assessm	n for admission to assessment, irsuant to Section 20 Subsection ule coordinators subsequently it, they will put the student's re- ive prerequisites can successful- or whose registration for an as- ent. If a student takes an as- isessment will not be considered
Workload				
150 h				
Teaching cycle	e			
Referred to in	LPOI (examination regul	lations for teaching-o	degree programmes)	
Module appea	ars in			
Bachelor's deg	gree (1 major) Nanostruct gree (1 major) Nanostruct	•,		

Module					Abbreviation				
	Industrial Internship 11-N-IP-152-mo1								
Module	e coord	inator		Module offered by					
		ector of the Institute of Ap		Faculty of Physics a	nd Astronomy				
ECTS		od of grading	Only after succ. com	pl. of module(s)					
10		rical grade							
Duratio		Module level	Other prerequisites						
1 seme	ster	undergraduate							
Conten	ts								
		ndustrial methods, work report and an oral prese		production method	s. Summary of own experiences				
Intende	ed leari	ning outcomes							
The students have knowledge and practical experience of using a variety of industrial technologies with relevan- ce to nanostructure technology and are able to summarise their experience in a report and an oral presentation.									
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)				
P (o) + 3	S (1)								
	Method of assessment (type, scope, language — if other than German, examination offered — if not every seme- ster, information on whether module can be chosen to earn a bonus)								
a) repo	rt on pi		5 pages) and b) prese	-	x. 45 minutes), weighted 1:4				
	Allocation of places								
Additio	Additional information								
this wil 3 Sente find tha gistratio ly regist sessme sessme	l be co ence 4 / at the s on for a ter for a ent was ent to w	nsidered a declaration of ASPO (general academic tudent has obtained the assessment into effect. O an assessment. Students s not put into effect will n	will to seek admission and examination regu qualification for adm nly those students the who did not register ot be admitted to the	on to assessment pu ulations). If the mod ission to assessmen at meet the respecti for an assessment o respective assessm	n for admission to assessment, irsuant to Section 20 Subsection ule coordinators subsequently t, they will put the student's re- ve prerequisites can successful- or whose registration for an as- ent. If a student takes an as- sessment will not be considered.				
Worklo	ad								
300 h									
Teachir	ıg cycl	е							
Referre	d to in	LPOI (examination regu	lations for teaching-o	legree programmes)					
Module	e appea	ars in							
		gree (1 major) Nanostruct	ure Technology (201	5)					
Bachelo	or's de	gree (1 major) Nanostruct	ure Technology (202	o)					

Module	e title				Abbreviation			
Nanote	Nanotechnology in Energy Research 11-NTE-152-mo1							
Module	e coord	inator		Module offered by	<u> </u>			
Manag	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	and Astronomy			
ECTS		od of grading	Only after succ. cor					
6	nume	rical grade						
Duratio	on	Module level	Other prerequisites	;				
1 seme	ster	graduate						
Conten	-							
Nanotechnology is of great significance for energy research. Energy efficiency can be heightened in numerous processes or applications by using special functional materials. This module covers special materials, surfaces and structures that have optimised properties due to effects of nanotechnology. It explains the underlying physical contexts. It uses specific materials and components as examples, such as thermal insulation materials, heat accumulators, functional nanoscale layer and particle systems with spectral selective properties, nanoporous vacuum insulations and electrode materials.								
	-	ning outcomes						
researd	ch. They	know methods of nan	nced knowledge of the otechnology to influen ge to specific question	ce the properties of	•	•,		
Course	s (type	, number of weekly cor	itact hours, language –	– if other than Germa	ın)			
V (3) + Module		t in: German or English						
			language — if other th		ition offered — if not	every seme-		
			can be chosen to earn	a bonus)				
b) oral c) oral d) proje e) pres If a writ stead t of asse nation Langua Assess	examin examin ect repo entatio tten exa ake the essmen date at age of a sment o	ation in groups (group ort (approx. 8 to 10 pag n/talk (approx. 30 min amination was chosen form of an oral examin t is changed, the lectur the latest. ssessment: German ar ffered: Once a year, su	e each (approx. 30 minutes of 2, approx. 30 minutes) or utes). as method of assessmenation of one candidate rer must inform studen	ites per candidate) o ent, this may be cha e each or an oral exa	nged and assessme mination in groups.	If the method		
Allocat	tion of p	olaces						
		, mation						
Adaltic	onal info	ormation						
 Worklo	ad							
180 h	bau							
		-						
Teacini	ng cycl	e						
Referre	ed to in	LPOI (examination re	gulations for teaching-	degree programmes)				
Module	e appea	irs in						
Bachel	or's de	gree (1 major) Nanostru	ıcture Technology (201 ıcture Technology (202	-				
		or Nanostructure Technology	JMU Würzburg	• generated 18-Apr-2025 • ex lor (180 ECTS) Nanostrukturte	-	page 120 / 150		

Bachelor's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Functional Materials (2022) exchange program Physics (2023) Master's degree (1 major) Functional Materials (2025)

Module	title				Abbreviation			
Novel T	Novel Transport Phenomena 11-NTP-152-m01							
Module	coord	inator		Module offered by				
Managi	ng Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	nd Astronomy			
ECTS		od of grading	Only after succ. com	pl. of module(s)				
6	nume	rical grade						
Duratio	n	Module level	Other prerequisites					
1 seme	ster	undergraduate						
Conten	ts							
	Current research topics and applications of novel transport phenomena.							
Intende	ed learr	ning outcomes						
The students have knowledge of a current subdiscipline of nanostructure technology or nano sciences, especially in the field of novel transport phenomena, and understand the measuring and evaluation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas. Courses (type, number of weekly contact hours, language — if other than German)								
		, number of weekly conta	ict nours, tanguage –	· II Other than Germa	11)			
V (3) + R (1) Module taught in: German or English								
ster, inf a) writte b) oral e d) proje If a writ stead ta of asse nation e Langua Allocati	formati en exar examin examin ect repo ten exa ake the ssmen date at ge of a ion of p	on on whether module can nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ort (approx. 8 to 10 pages amination was chosen as form of an oral examina- t is changed, the lecturer the latest. ssessment: German and	an be chosen to earn 20 minutes) or ach (approx. 30 minu of 2, approx. 30 minu of presentation/tal method of assessme tion of one candidate must inform student	a bonus) utes) or tes per candidate) or k (approx. 30 minute ent, this may be char e each or an oral exar				
Worklo	ad							
180 h								
Teachir	ng cycl	9						
Referre	d to in	LPOI (examination regu	lations for teaching-o	legree programmes)				
Module	appea	irs in						
		gree (1 major) Nanostruct						
		gree (1 major) Nanostruct		o)				
Bachelo	or's de	gree (1 major) Quantum T	echnology (2021)					

Module title				Abbreviation		
Data and Erro	or Analysis			11-P-FR1-152-m01		
Module coord	linator		Module offered by			
	rector of the Institute of <i>i</i>	Applied Physics	Faculty of Physics a	nd Astronomy		
	od of grading	Only after succ. con	, ,	and Astronomy		
	successfully completed					
Duration	Module level	Other prerequisites	;			
1 semester	undergraduate	Admission prerequisite to assessment: completion of exercises (appro 13 exercise sheets per semester). Students who successfully complete approx. 50% of exercises will qualify for admission to assessment. The lecturer will inform students about the respective details at the beginn of the semester.				
Contents						
Types of error and standard	rs, error approximation a deviation.	and propagation, grapl	hic representations,	linear regression, m	ean values	
Intended lear	rning outcomes	_				
	are able to evaluate me I to draw, present and d			gation and of the pr	inciples of	
Courses (type	e, number of weekly con	tact hours, language –	– if other than Germa	n)		
V (1) + Ü (1) Module taugł	nt in: Ü: German or Engli	sh				
	sessment (type, scope, tion on whether module			tion offered — if no	t every seme-	
	ination (approx. 120 mir assessment: German an					
Allocation of						
	•					
Additional in	formation					
this will be co 3 Sentence 4 find that the gistration for ly register for sessment wa	If a student registers for onsidered a declaration ASPO (general academi student has obtained th assessment into effect. an assessment. Studen s not put into effect will which he/she has not be	of will to seek admissi c and examination reg e qualification for adm Only those students th ts who did not register not be admitted to the	on to assessment pu ulations). If the mod hission to assessmer hat meet the respect r for an assessment of respective assessm	rsuant to Section 2 ule coordinators su it, they will put the ive prerequisites ca or whose registratio ent. If a student tak	o Subsection bsequently student's re- n successful- n for an as- xes an as-	
Workload						
60 h						
Teaching cyc	le					
	LPOI (examination reg	gulations for teaching-	degree programmes)			
§ 53 Nr. 1 c) § 77 Nr. 1 d)						
Module appe	ars in					
Bachelor's de	egree (1 major) Mathema egree (1 major) Physics (egree (1 major) Nanostru	2015)	5)			

UNIVERSITÄT WÜRZBURG

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

Module coordinatoManaging DirectorECTSMethod of2(not) succe2(not) succeDurationMod1 semesterund1 semesterundAdvanced methodsdataContentsataAdvanced methodsdataIntended learringThe students havestered methods ofdiscuss the resultsCourses (type, numV (1) + Ü (1)Method of assesserster, information oExercises (success)success	of the Institute of Ap grading essfully completed dule level ergraduate s of data analysis an a analysis. outcomes advanced knowledg computerised data a	oplied Physics Only after succ. con Other prerequisites Students are highly completing module ad error calculation. D	recommended to co 11-P-FR2. Distribution function, neasuring data and o	mplete module 11-P-FR1 prior to significance tests, modelling. error calculation. They have ma-
Managing DirectorMethod of2(not) succeDurationMod1 semesterund1 semesterundContentsAdvanced methodsContentsAdvanced methodsIntended learringThe students have stered methods of discuss the resultsCourses (type, numV (1) + Ü (1)Method of assessmentExercises (success Assessment offeredAllocation of placeAdditional informationMorkload	of the Institute of Ap grading essfully completed dule level ergraduate s of data analysis an a analysis. outcomes advanced knowledg computerised data a	Only after succ. con Other prerequisites Students are highly completing module d error calculation. D ge of the analysis of r	Faculty of Physics a npl. of module(s) recommended to co 11-P-FR2. Distribution function,	mplete module 11-P-FR1 prior to significance tests, modelling. error calculation. They have ma-
Managing DirectorMethod of2(not) succeDurationMod1 semesterund1 semesterundContentsAdvanced methodsContentsAdvanced methodsContentsIntended learringThe students havestered methods ofdiscuss the resultsCourses (type, numV (1) + Ü (1)Method of assessment offereAllocation of placeAdditional informationMorkload	of the Institute of Ap grading essfully completed dule level ergraduate s of data analysis an a analysis. outcomes advanced knowledg computerised data a	Only after succ. con Other prerequisites Students are highly completing module d error calculation. D ge of the analysis of r	Faculty of Physics a npl. of module(s) recommended to co 11-P-FR2. Distribution function,	mplete module 11-P-FR1 prior to significance tests, modelling. error calculation. They have ma-
ECTS Method of 2 (not) succe Duration Mod 1 semester und Contents Advanced methods Advanced methods data Intended learning The students have stered methods of discuss the results Courses (type, num V (1) + Ü (1) Method of assessment offere Allocation of place Additional informa Workload	grading essfully completed dule level ergraduate s of data analysis an a analysis. outcomes advanced knowledg computerised data a	Only after succ. con Other prerequisites Students are highly completing module d error calculation. D ge of the analysis of r	npl. of module(s) recommended to co 11-P-FR2. Distribution function, neasuring data and o	mplete module 11-P-FR1 prior to significance tests, modelling. error calculation. They have ma-
2 (not) succe Duration Mod 1 semester und 1 semester und Advanced methods data Advanced methods data Intended learning The students have Stered methods of discuss the results Courses (type, num V (1) + Ü (1) Method of assessment offere Allocation of place Additional information Workload	essfully completed dule level ergraduate s of data analysis an a analysis. outcomes advanced knowledg computerised data a	 Other prerequisites Students are highly completing module ad error calculation. D ge of the analysis of r	recommended to co 11-P-FR2. Distribution function, neasuring data and o	significance tests, modelling. error calculation. They have ma-
Duration Model 1 semester und 1 semester und Contents Advanced methods Advanced methods data Intended learring The students have stered methods of discuss the results Courses (type, num V (1) + Ü (1) Method of assessmater, information o Exercises (success Assessment offere Allocation of place Additional informater Workload	dule level ergraduate s of data analysis an a analysis. outcomes advanced knowledg computerised data a	Students are highly completing module ad error calculation. D ge of the analysis of r	recommended to co 11-P-FR2. Distribution function, neasuring data and o	significance tests, modelling. error calculation. They have ma-
1 semester und Contents Advanced methods Advanced methods data Intended learning The students have Stered methods of discuss the results Courses (type, num V (1) + Ü (1) Method of assessment offere Allocation of place Additional informa Workload	ergraduate s of data analysis an a analysis. outcomes advanced knowledg computerised data a	Students are highly completing module ad error calculation. D ge of the analysis of r	recommended to co 11-P-FR2. Distribution function, neasuring data and o	significance tests, modelling. error calculation. They have ma-
Contents Advanced methods Computerised data Intended learning The students have stered methods of discuss the results Courses (type, nun V (1) + Ü (1) Method of assessm ster, information o Exercises (success Assessment offere Allocation of place Additional informa Workload	s of data analysis an a analysis. outcomes advanced knowledg computerised data a	completing module nd error calculation. D ge of the analysis of r	11-P-FR2. Distribution function, neasuring data and o	significance tests, modelling. error calculation. They have ma-
Advanced methods Computerised data Intended learning The students have stered methods of discuss the results Courses (type, num V (1) + Ü (1) Method of assessm ster, information o Exercises (success Assessment offere Allocation of place Additional informa Workload	a analysis. outcomes advanced knowledg computerised data a	ge of the analysis of r	neasuring data and o	error calculation. They have ma-
Computerised data Intended learning The students have stered methods of discuss the results Courses (type, num V (1) + Ü (1) Method of assessm ster, information o Exercises (success Assessment offere Allocation of place Additional informa Workload	a analysis. outcomes advanced knowledg computerised data a	ge of the analysis of r	neasuring data and o	error calculation. They have ma-
The students have stered methods of discuss the results Courses (type, num V (1) + Ü (1) Method of assessm ster, information o Exercises (success Assessment offere Allocation of place Additional informa Workload	advanced knowledg computerised data a			
stered methods of discuss the results Courses (type, num V (1) + Ü (1) Method of assessin ster, information o Exercises (success Assessment offere Allocation of place Additional informa Workload	computerised data a			
V (1) + Ü (1) Method of assessm ster, information o Exercises (success Assessment offere Allocation of place Additional informa Workload	nber of weekly conta			
Method of assessm ster, information o Exercises (success Assessment offere Allocation of place Additional informa Workload		act hours, language –	– if other than Germa	ın)
ster, information o Exercises (success Assessment offere Allocation of place Additional informa Workload		-		
Assessment offere Allocation of place Additional informa Workload		anguage — if other th an be chosen to earn		tion offered — if not every seme-
 Additional informa Workload	ful completion of ap d: Once a year, sum	prox. 50% of approx. mer semester	. 10 exercise sheets)	
 Workload	S			
 Workload				
	tion			
60 h				
0011				
Teaching cycle				
Referred to in LPO	I (examination regu	llations for teaching-	degree programmes)	
	. (channation regu			
Modulo appoare in				
Module appears in	(1 major) Physics (20	045)		
		u15) ture Technology (201)	c)	
-	(1 major) Mathemati		5)	
	(1 major) Mathemati	• •		
-	(1 major) Physics (20	•		
•		ture Technology (202	0)	
-	(1 major) Mathemati		/	
-	(1 major) Functional	•		
-	(1 major) Quantum T			
exchange program				
		ical Physics (2024)		
Bachelor's degree		•		

Module title	9			Abbreviation	
Project Mar	agement in Practice			11-PMP-152-m01	
Module coordinator			Module offered by	<u> </u>	
	virector of the Institute of A	Applied Physics	Faculty of Physics a	nd Astronomy	
	thod of grading	<u> </u>	Only after succ. compl. of module(s)		
	t) successfully completed				
Duration	Module level	Other prerequisites			
1 semester	graduate				
Contents	0				
project sche porting, cor	roject management in pra edule, kick-off and stakeh iflicts, success factors, teo mplary cases	older, teams and reso	urces, milestones an	d planning, visualis	ation and re-
Intended le	arning outcomes				
	s have knowledge of tech tors and are able to define			ar with different met	thods and
Courses (ty	pe, number of weekly cont	act hours, language –	– if other than Germa	in)	
V(1) + R(1) Module tau	ght in: German or English				
	assessment (type, scope, ation on whether module			tion offered — if not	t every seme-
stead take t of assessme nation date Language o	examination was chosen a the form of an oral examin ent is changed, the lecture at the latest. f assessment: German an	ation of one candidat er must inform studen d/or English	e each or an oral exa ts about this by four	mination in groups. weeks prior to the o	If the methoc riginal exami
	t offered: In the semester	in which the course is	offered and in the si	ubsequent semester	r
Allocation of	of places				
Additional i	nformation				
Workload					
90 h					
Teaching cy	rcle				
Referred to	in LPO I (examination reg	ulations for teaching-	degree programmes)		
Module app	ears in				
	degree (1 major) Physics (2	2015)			
	degree (1 major) Nanostru	-	.5)		
	degree (1 major) Physics (2				
	degree (1 major) Nanostru		20)		
Bachelor's o	degree (1 major) Quantum	Technology (2021)			
	major Nanostructure Technology		• generated 18-Apr-2025 • example		page 126 / 150
2015)		ta record Bache	lor (180 ECTS) Nanostrukturte	chnik - 2015	

I abor-	Module title			Abbreviation	
Laboratory Course Physics B (Classical Physics, Electricity,			ll Physics, Electricity,	, Circuits)	11-P-NB-152-m01
Module coordinator				Module offered by	
Manag	ing Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	and Astronomy
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
4	(not)	successfully completed			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			mplete modules 11-P-PA and 11-
			P-FR1 prior to compl	leting module 11-P-N	В.
Conten	Its		-		
Physic	al laws	of optics, vibrations and	waves, science of ele	ectricity and circuits	with electric components.
Intend	ed lear	ning outcomes			
le to in measu princip	depend ring pro les of s	dently plan and conduct o otocol. They are able to e statistics and to draw, pre	experiments, to coop valuate the measurin esent and discuss the	erate with others, ar g results on the bas e conclusions.	menting techniques. They are ab- nd to document the results in a is of error propagation and of the
	s (type	, number of weekly conta	act hours, language –	- if other than Germa	in)
P (2)					
		s essment (type, scope, la ion on whether module c			tion offered — if not every seme-
Prepari cessful can be candid	ing, pei lly com repeat ate's u	pleted if a Testat (exam) ed once. After completion	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents	lab report) the expe e experiment that wa talk (with discussior of the module. Talks	riments will be considered suc- as not successfully completed h; approx. 30 minutes) to test the that were not successfully com- uccessfully completed.
Prepari cessful can be candid	ing, pei Ily com repeat ate's u can be	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents	lab report) the expe e experiment that wa talk (with discussior of the module. Talks	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com-
Prepari cessful can be candid pleted	ing, pei Ily com repeat ate's u can be	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents	lab report) the expe e experiment that wa talk (with discussior of the module. Talks	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com-
Prepari cessful can be candid pleted Allocat	ing, pei lly com repeat ate's u can be ion of j	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents	lab report) the expe e experiment that wa talk (with discussior of the module. Talks	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com-
Prepari cessful can be candid pleted Allocat	ing, pei lly com repeat ate's u can be ion of j	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com places	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents	lab report) the expe e experiment that wa talk (with discussior of the module. Talks	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com-
Prepari cessful can be candid pleted Allocat	ing, pel lly com repeat ate's u can be ion of p	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com places	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents	lab report) the expe e experiment that wa talk (with discussior of the module. Talks	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com-
Prepari cessful can be candid pleted Allocat Additic	ing, pel lly com repeat ate's u can be ion of p	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com places	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents	lab report) the expe e experiment that wa talk (with discussior of the module. Talks	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com-
Prepari cessful can be candid pleted Allocat Additic	ing, per lly com repeat ate's u can be ion of p onal inf	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com places	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents	lab report) the expe e experiment that wa talk (with discussior of the module. Talks	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com-
Prepari cessful can be candid pleted Allocat Additic Worklo 120 h	ing, per lly com repeat ate's u can be ion of p onal inf	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com places	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents	lab report) the expe e experiment that wa talk (with discussior of the module. Talks	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com-
Prepari cessful can be candid pleted Allocat Morklo 120 h Teachi 	ing, per lly com repeat ate's u can be ion of p onal inf pad	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com places	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents nponents of the asse	lab report) the expe e experiment that we talk (with discussion of the module. Talks ssment have to be s	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com- uccessfully completed.
Prepari cessful can be candid pleted Allocat Morklo 120 h Teachi 	ing, per lly com repeat ate's u can be ion of p onal inf pad	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both con places	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents nponents of the asse	lab report) the expe e experiment that we talk (with discussion of the module. Talks ssment have to be s	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com- uccessfully completed.
Prepari cessful can be candid pleted Allocat Morklo 120 h Teachi 	ing, pel lly com repeat ate's u can be ion of p onal inf pad	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com places formation	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents nponents of the asse	lab report) the expe e experiment that we talk (with discussion of the module. Talks ssment have to be s	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com- uccessfully completed.
Prepari cessful can be candid pleted Allocat Additic 120 h Teachi Referre Modulo	ing, pei lly com repeat ate's u can be ion of p onal inf pad	rforming and evaluating (pleted if a Testat (exam) ed once. After completion nderstanding of the phys repeated once. Both com places formation	. 30 minutes) (record of readings or is passed. Exactly on n of all experiments, sics-related contents nponents of the asse	lab report) the expe e experiment that wa talk (with discussion of the module. Talks ssment have to be s	as not successfully completed n; approx. 30 minutes) to test the that were not successfully com- uccessfully completed.

Module	title				Abbreviation
Advanced Laboratory Course Physics C (Modern Physics, C			C (Modern Physics, C	omputer Aided Ex-	11-P-NC-152-m01
perime				1	
Module	<u>coord</u>	inator		Module offered by	
Managi	ng Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	and Astronomy
ECTS		od of grading	Only after succ. con	npl. of module(s)	
4	(not) s	successfully completed			
Duratio		Module level	Other prerequisites		
1 semes	ster	undergraduate	. ,		mplete module 11-P-NB prior to
			completing module	11-P-NC.	
Conten	ts				
		of wave optics, Molecula ised devices with examp			rn measuring methods using spe-
Intende	ed lear	ning outcomes			
to recor by usin	rd mea g error	suring results in a structu	ured manner, even in cs. They are able to e	case of huge data tr	erimental setups. They are able affic, and to analyse the results raw conclusions and to present
Course	s (type	, number of weekly conta	ict hours, language –	- if other than Germa	in)
P (2)					
		sessment (type, scope, la ion on whether module c			tion offered — if not every seme-
Prepari cessful can be candida	ng, pei ly com repeat ate's u	pleted if a Testat (exam) ed once. After completion	record of readings or is passed. Exactly on n of all experiments, ics-related contents o	e experiment that wa talk (with discussion of the module. Talks	riments will be considered suc- as not successfully completed a; approx. 30 minutes) to test the that were not successfully com- uccessfully completed.
Allocat	ion of _l	olaces			
Additio	nal inf	ormation			
Worklo	ad				
120 h					
Teachir	ng cựcl	ρ	-		
reaciiii	יה נענו				
Referre	d to in	LPOI (examination regu	lations for teaching	legree programmoc)	
Referre				active programmes)	
 Module	annes	ars in			
		gree (1 major) Nanostruct	ture Technology (2014	-)	
		gree (1 major) Nanostruct			
Dachell	51 5 UC	Sice (I major) Nanostiuci	(202) (202	0)	

	e title			Abbreviation
Laboratory Course Physics A (Mechanics, Heat, Electron			gnetism)	11-P-PA-152-m01
Module coordinator			Module offered	 bv
Managing Director of the Institute of Applied Physics		Applied Physics	1	ics and Astronomy
-		<u></u>	· · · · ·	· · ·
ECTS 3	Method of grading (not) successfully completed	Only after succ. cor		
			_	
Durati		Other prerequisites	5	
1 seme				
Conter	nts			
rents,		sity of bodies, dynami	ic viscosity, elas	.g. measurement of voltages and c icity, surface tension, spring con-
Intend	ed learning outcomes			
le to in				perimenting techniques. They are a s, and to document the results in a
Course	es (type, number of weekly con	tact hours, language –	– if other than G	erman)
P (2)				
Metho	d of assessment (type, scope,	 language — if other th	an German, exa	nination offered — if not every sem
	formation on whether module			······································
candic pleted		sics-related contents	of the module. T	sion; approx. 30 minutes) to test th alks that were not successfully con be successfully completed.
∆dditi	onal information			
Addition				
 \\\\ = #\ + +				
Worklo	Dad			
90 h				
Teachi	ng cycle			
	ed to in LPO I (examination reg	gulations for teaching-	degree programı	nes)
	ed to in LPO I (examination reg	gulations for teaching-	degree programi	nes)
Referro		ulations for teaching-	degree programı	nes)
Referro Modul	e appears in		degree programı	nes)
Referre Modul Bache	e appears in lor's degree (1 major) Mathema	tics (2015)	degree programı	nes)
Referr Modul Bache Bache	e appears in lor's degree (1 major) Mathema lor's degree (1 major) Physics (itics (2015) 2015)		nes)
Referro Bache Bache Bache	e appears in lor's degree (1 major) Mathema	itics (2015) 2015) cture Technology (201		nes)
Referro Bache Bache Bache Bache Bache	e appears in lor's degree (1 major) Mathema lor's degree (1 major) Physics (lor's degree (1 major) Nanostru	itics (2015) 2015) cture Technology (201 itical Physics (2015)	5)	nes)
Referro Bache Bache Bache Bache Bache Bache	e appears in lor's degree (1 major) Mathema lor's degree (1 major) Physics (lor's degree (1 major) Nanostru lor's degree (1 major) Mathema	itics (2015) 2015) cture Technology (201 itical Physics (2015) tional Mathematics (2	5) 015)	nes)
Referro Bache Bache Bache Bache Bache Bache Bache	e appears in lor's degree (1 major) Mathema lor's degree (1 major) Physics (lor's degree (1 major) Nanostru lor's degree (1 major) Mathema lor's degree (1 major) Computa	itics (2015) 2015) cture Technology (201 itical Physics (2015) tional Mathematics (2 e Computer Science (:	5) 015)	nes)
Referro Bache Bache Bache Bache Bache Bache Bache Bache Bache	e appears in lor's degree (1 major) Mathema lor's degree (1 major) Physics (lor's degree (1 major) Nanostru lor's degree (1 major) Mathema lor's degree (1 major) Aerospac lor's degree (1 major) Mathema lor's degree (1 major) Aerospac	itics (2015) 2015) cture Technology (201 itical Physics (2015) tional Mathematics (2 e Computer Science (2 itical Physics (2016) e Computer Science (2)	5) 015) 2015)	nes)
Referro Bache Bache Bache Bache Bache Bache Bache Bache Bache	e appears in lor's degree (1 major) Mathema lor's degree (1 major) Physics (lor's degree (1 major) Nanostru lor's degree (1 major) Mathema lor's degree (1 major) Aerospac lor's degree (1 major) Aerospac lor's degree (1 major) Aerospac lor's degree (1 major) Physics (itics (2015) 2015) cture Technology (201 itical Physics (2015) tional Mathematics (2 e Computer Science (2 itical Physics (2016) e Computer Science (2 2020)	5) 015) 2015) 2017)	nes)
Referro Bache Bache Bache Bache Bache Bache Bache Bache Bache	e appears in lor's degree (1 major) Mathema lor's degree (1 major) Physics (lor's degree (1 major) Nanostru lor's degree (1 major) Mathema lor's degree (1 major) Aerospac lor's degree (1 major) Mathema lor's degree (1 major) Aerospac	itics (2015) 2015) cture Technology (201 itical Physics (2015) tional Mathematics (2 e Computer Science (2 itical Physics (2016) e Computer Science (2 2020)	5) 015) 2015) 2017)	nes)
Referro Bache Bache Bache Bache Bache Bache Bache Bache Bache Bache	e appears in lor's degree (1 major) Mathema lor's degree (1 major) Physics (lor's degree (1 major) Nanostru lor's degree (1 major) Mathema lor's degree (1 major) Aerospac lor's degree (1 major) Aerospac lor's degree (1 major) Aerospac lor's degree (1 major) Physics (itics (2015) 2015) cture Technology (201 itical Physics (2015) tional Mathematics (2 e Computer Science (2 itical Physics (2016) e Computer Science (2 2020) cture Technology (202	5) 015) 2015) 2017)	5 • exam. reg. da-

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

Module	e title				Abbreviation
Laboratory Course Physical Technology of Material Synthetics			y of Material Synthe	sis	11-PPT-152-m01
Module	coord	inator		Module offered by	
			anlied Physics	Faculty of Physics and Astronomy	
ECTS		ector of the Institute of Ap od of grading	Only after succ. con		
8		successfully completed			
Duratio	L	Module level	Other prerequisites		
1 seme		undergraduate			onal Materials, Bachelor's) are
		Ū	recommended to ta	ke module 11-P-FR1.	
Conten	ts		1		
Physica nologie		rial properties, growth ar	nd coating procedure	s, methods of charad	cterisation and structuring tech-
Intende	ed learı	ning outcomes			
	dents l	nave knowledge of the p	ractical basics of mat	erial characterisation	n and physical technology for ma-
Course	s (type	, number of weekly conta	ict hours, language –	- if other than Germa	in)
P (5) Module	taugh	t in: German or English			
			if other th	an Corman, ovamina	tion offered — if not every seme-
		on on whether module c			liton onered — If not every seme-
Prepara	ation of	the experiment will be c	onsidered successfu	lly completed if a pre	e-experiment oral test (approx. 15
if a Test sessme en succ ted. Langua	tat (exa ent can cessfull ge of a	am) is passed. An experine be repeated once in the	nent log (approx. 8 p respective semester. semester will the mo /or English	ages) must be prepa Only if both compor	red successfully completed if a ned. Each component of the as- nents of the assessment have be- considered successfully comple-
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
240 h					
Teachir	ng cycl	e			
Referre	d to in	LPOI (examination regu	lations for teaching-	degree programmes)	
Module	e appea	irs in			
		gree (1 major) Nanostruc	ture Technology (201	5)	
		gree (1 major) Functional		-	
Bachel	or's de	gree (1 major) Nanostruc	ture Technology (202	o)	

Module	e title				Abbreviation	
Prepara	atory C	ourse Mathematics			11-P-VKM-152-m01	
Module	coord	inator		Module offered by	<u> </u>	
		ectors of the Institute of	Applied Physics and	Faculty of Physics a	nd Astronomy	
-	-	f Theoretical Physics ar			and Astronomy	
ECTS Method of grading Only after succ. compl. of module(s)						
2	1	successfully completed				
Duratio	n	Module level	Other prerequisites	6		
1 seme	ster	undergraduate				
Conten	ts		1			
the intr 1. Basic 2. Coor 3. Vecto 4. Diffe 5. Integ Intende The stu success Course T (2) Method ster, int a) exerc	oduction geom dinate ors - ve rential gral calo ed learn dents I sfully s s (type d of ass formation	nathematics and eleme on to and preparation for etry and algebra systems and complex r ctored values calculus culus ning outcomes know the principles of r tudying Theoretical and number of weekly com eessment (type, scope, on on whether module successful completion of x. 15 minutes)	or the modules of Expension numbers nathematics and elem I Experimental Physics tact hours, language – language – if other th can be chosen to earn	entary calculation m - if other than Germa an German, examina a bonus)	ethods which are re n) tion offered — if not	quired for
Allocat 	ion of p	ffered: Once a year, wir blaces ormation	iter semester			
Worklo	ad					
60 h						
		0				
Teachi	ig tyti	6				
§ 22 § 22	Nr. 1 h) Nr. 2 f)	LPOI (examination reg	guiations for teaching-	aegree programmes)		
§ 22	-	•				
Module						
		gree (1 major) Physics (; gree (1 major) Napostru	-	с)		
		gree (1 major) Nanostru gree (1 major) Mathema		5/		
		gree (1 major, 1 minor) F				
		mination for the teaching		e Physics (2015)		
		mination for the teaching		•	s (Primary School) (2	2015)
		mination for the teaching		•		
		mination for the teaching				
Bachelor's (2015)	with 1 ma	or Nanostructure Technology		e generated 18-Apr-2025 • exa or (180 ECTS) Nanostrukturte		page 132 / 150
/ر						

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

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

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

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

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

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

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

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

Statist	e title			Abbreviation			
	ics, Data Analysis and Compute	er Physics		11-SDC-152-m01			
Module coordinator			Module offered by				
Managing Director of the Institute of Applied Physics Faculty of Physics and Astronomy							
ECTS	Method of grading	thod of grading Only after succ. compl. of module(s)					
4	numerical grade						
Duratio	on Module level	Other prerequisites	S				
1 seme	ster graduate						
Conten	ts						
Statisti	cs, data analysis and computer	- r nhysics					
	ed learning outcomes						
			<u> </u>				
Physics	idents have specific and advand	ced knowledge in the	e field of statistics, da	ita analysis and Con	nputational		
				```			
	s (type, number of weekly conta	act hours, language -	– If other than Germa	n)			
V (2) +							
	e taught in: German or English						
	d of assessment (type, scope, la			tion offered — if not	every seme-		
	formation on whether module c		i a bonus)				
	en examination (approx. 90 to a						
	examination of one candidate e examination in groups (groups			r			
	ect report (approx. 8 to 10 page		ates per candidate) of				
	entation/talk (approx. 30 minut						
			ient, this may be chai	nged and assessme	nt may in-		
	ake the form of an oral examina	If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method					
- C				<b>e</b> ,	If the method		
	ssment is changed, the lecture			<b>e</b> ,	If the method		
nation	date at the latest.	r must inform studen		<b>e</b> ,	If the method		
nation Langua	date at the latest. ge of assessment: German and	r must inform studen I/or English		<b>e</b> ,	If the method		
nation Langua Assess	date at the latest. ge of assessment: German and ment offered: Once a year, wint	r must inform studen I/or English		<b>e</b> ,	If the method		
nation Langua Assess	date at the latest. ge of assessment: German and	r must inform studen I/or English		<b>e</b> ,	If the method		
nation Langua Assess Allocat	date at the latest. ige of assessment: German and ment offered: Once a year, wint <b>ion of places</b>	r must inform studen I/or English		<b>e</b> ,	If the method		
nation Langua Assess Allocat	date at the latest. ge of assessment: German and ment offered: Once a year, wint	r must inform studen I/or English		<b>e</b> ,	If the method		
nation Langua Assess Allocat	date at the latest. ige of assessment: German and ment offered: Once a year, wint <b>ion of places</b>	r must inform studen I/or English		<b>e</b> ,	If the method		
nation Langua Assess Allocat	date at the latest. ge of assessment: German and ment offered: Once a year, wint ion of places mal information	r must inform studen I/or English		<b>e</b> ,	If the method		
nation Langua Assess Allocat  Additio	date at the latest. ge of assessment: German and ment offered: Once a year, wint ion of places mal information	r must inform studen I/or English		<b>e</b> ,	If the method		
nation Langua Assess Allocat  Additio  Worklo 120 h	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information ad	r must inform studen I/or English		<b>e</b> ,	If the method		
nation Langua Assess Allocat  Additio  Worklo 120 h	date at the latest. ge of assessment: German and ment offered: Once a year, wint ion of places mal information	r must inform studen I/or English		<b>e</b> ,	If the method		
nation Langua Assess Allocat  Additio  Worklo 120 h Teachin 	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information ad ng cycle	r must inform studen I/or English ter semester	ts about this by four	• •	If the method		
nation Langua Assess Allocat  Additio  120 h Teachin 	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information ad	r must inform studen I/or English ter semester	ts about this by four	• •	If the method		
nation Langua Assess Allocat  Additio  120 h Teachin  Referre 	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information mad ng cycle ed to in LPO I (examination regu	r must inform studen I/or English ter semester	ts about this by four	• •	If the method		
nation ( Langua Assess Allocat  Morklo 120 h Teachin  Referre  Module	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information ad ad ad ed to in LPO I (examination regulation) e appears in	r must inform studen I/or English ter semester 	ts about this by four	• •	If the method		
nation Langua Assess Allocat  Morklo 120 h Teachin  Referre Bachelo	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information ad ad ad ed to in LPO I (examination regulation e appears in or's degree (1 major) Physics (2	r must inform studen l/or English ter semester 	ts about this by four degree programmes)	• •	If the method		
nation Langua Assess Allocat  Additio  120 h Teachin  Referre Bachelo Bachelo	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places onal information ad ad ad ad e appears in or's degree (1 major) Physics (2 or's degree (1 major) Nanostruc	r must inform studen I/or English ter semester ulations for teaching- 015) :ture Technology (201	ts about this by four degree programmes)	• •	If the method		
nation Langua Assess Allocat  Additio  120 h Teachin  Referre  Bachelo Bachelo	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information ad ed to in LPO I (examination regu e appears in or's degree (1 major) Physics (2 or's degree (1 major) Mathemat	r must inform studen l/or English ter semester 	ts about this by four degree programmes)	• •	If the method		
nation Langua Assess Allocat  Additio  120 h Teachin  Referre Bachelo Bachelo Bachelo	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information ad ad ad ad ad ad ad ad ad ad	r must inform studen l/or English ter semester ulations for teaching- 015) ture Technology (201 cical Physics (2015) tical Physics (2016)	ts about this by four degree programmes)	• •	If the method		
nation Langua Assess Allocat  Additio  Yorklo 120 h Teachin  Referre Bachelo Bachelo Bachelo Bachelo	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information ad ad ad ad ad ad ad ad ad ad	r must inform studen l/or English ter semester ulations for teaching- 015) ture Technology (201 tical Physics (2015) tical Physics (2016) 020)	ts about this by four degree programmes)	• •	If the method		
nation Langua Assess Allocat  Additio  120 h Teachin  Referre Bachelo Bachelo Bachelo Bachelo Bachelo	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information ad ad ad ad ad ad ad ad ad ad	r must inform studen I/or English ter semester ulations for teaching- co15) ture Technology (201 cical Physics (2016) co20) ture Technology (202	ts about this by four degree programmes)	• •	If the method		
nation Langua Assess Allocat  Additio  120 h Teachin  Referre  Bachelo Bachelo Bachelo Bachelo Bachelo Bachelo Bachelo	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information ad ad ad ad ad ad ad ad by a prease in or's degree (1 major) Physics (2 or's degree (1 major) Mathemat or's degree (1 major) Mathemat or's degree (1 major) Mathemat or's degree (1 major) Nanostruc or's degree (1 major) Nanostruc or's degree (1 major) Nanostruc or's degree (1 major) Nanostruc or's degree (1 major) Mathemat or's degree (1 major) Mathemat	r must inform studen l/or English ter semester ulations for teaching- co15) ture Technology (201 cical Physics (2015) cical Physics (2016) o20) ture Technology (202 cical Physics (2020)	ts about this by four degree programmes)	• •	If the method		
nation Langua Assess Allocat  Additio  120 h Teachin  Referre Bachelo Bachelo Bachelo Bachelo Bachelo Bachelo Bachelo Bachelo Bachelo	date at the latest. Ige of assessment: German and ment offered: Once a year, wint ion of places mal information ad ad ad ad ad ad ad ad ad ad	r must inform studen l/or English ter semester ulations for teaching- cical Physics (2015) cical Physics (2016) o20) ture Technology (202 cical Physics (2020) Technology (2021)	ts about this by four degree programmes)	weeks prior to the o	If the method		



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

Module title	Abbreviation			
Physics of Semiconductor Devices			11-SPD-152-m01	
Module coordinator		Module offered by		
Managing Director of the Institute of A	pplied Physics	Faculty of Physics a	ind Astronomy	
ECTS Method of grading	Only after succ. con	npl. of module(s)		
6 numerical grade				
Duration Module level	Other prerequisites	<b>i</b>		
1 semester undergraduate				
Contents				
Contents Based on the fundamentals of Semiconductor Physics, the lecture provides an insight into semiconductor key technologies and discusses the main components in the fields of electronics and photonics on the basis of ex- amples. The basic part introduces the crystal structures and band and phonon dispersions of technologically re- levant semiconductors. The following part discusses the principles of charge transport involving non-equilibrium effects based on the charge carrier density of the thermal equilibrium. The part on technology gives an insight into the methods of production of semiconductor materials and presents the most important methods of planar technology. It discusses the way of functioning of the following components, sorted according to volume com- ponents, interface components and application fields: Rectifier diodes, Zener diodes, varistor, varactor, tunnel diodes, IMPATT, Baritt- and Gunn diodes, photodiode, solar cell, LED, semiconductor injection laser, transistor, JFET, Thyristor, Diac, Triac, Schottky diode, MOSFET, MESFET, HFET. It highlights the importance of low-dimensio- nal charge carrier systems for technology and basic research and shows recent developments in the components sector.  Intended learning outcomes The students know the characteristics of semiconductors, they have gained an overview of the electronic and phonon band structures of important semiconductors and the resulting electronic, optical and thermal proper- ties. They know the principles of charge transport as well as the Poisson, Boltzmann and continuity equation for the solution of questions. They have gained insights into the methods of semiconductor production and are fa- miliar with the theories of planar technology and recent developments in this field, they have a basic understan- ding of component production. They understand the structure and way of functioning of the main components of electronics (diode, transistor, field-effect transistor, thristor, diaz, triac), of microwave applications (tunnel, Im				
<b>Courses</b> (type, number of weekly conta	act hours, language –	- if other than Germa	in)	
V (3) + R (1) Module taught in: German or English				
<b>Method of assessment</b> (type, scope, la ster, information on whether module c			tion offered — if not every seme-	
a) written examination (approx. 90 to a b) oral examination of one candidate of c) oral examination in groups (groups d) project report (approx. 8 to 10 page e) presentation/talk (approx. 30 minut If a written examination was chosen as stead take the form of an oral examinat of assessment is changed, the lecture nation date at the latest. Language of assessment: German and Assessment offered: Once a year, sum	each (approx. 30 minu of 2, approx. 30 minu s) or tes). s method of assessm ation of one candidate r must inform student /or English	ites per candidate) o ent, this may be chan e each or an oral exa	nged and assessment may in- mination in groups. If the method	
Allocation of places				

#### **Additional information**

# Workload

# 180 h

## Teaching cycle

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

## Module appears in

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

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

Master's degree (1 major) Functional Materials (2016)

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

Bachelor's degree (1 major) Nanostructure Technology (2020)

Bachelor's degree (1 major) Quantum Technology (2021)

Master's degree (1 major) Functional Materials (2022)

exchange program Physics (2023)

Master's degree (1 major) Functional Materials (2025)

Module	Module title Abbreviation				
Electroo					11-T-E-152-m01
Module	coordi	nator		Module offered by	
Managing Director of the Institute of Theoretical Physics Faculty of P and Astrophysics				Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
8	numer	ical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	undergraduate			
Content	ts				
<ul> <li>o. Mathematical tools: Gradient, divergence, curl; curve, surface, volume integrals; Stokes and Gaussian sentence; Delta function; Fourier transform; full functional systems; solving PDEs;</li> <li>1. Maxwell equations;</li> <li>2. Electrostatics: Coulomb's law; electrostatic potential; charged interface; electrostatic field energy (capacitor); multipole expansion; Boundary value problems; numerical solution; Image charges; Green's functions; development according to orthogonal functions;</li> <li>3. Magnetostatics: Current density; continuity equation; vector potential; Biot-Savart law; magnetic moment; analogies to electrostatics;</li> <li>4. Maxwell equations in matter: Electrical and magnetic susceptibility; interfaces;</li> <li>5. Dynamics of electromagnetic fields: Faraday induction; RCL-circuits; field energy and pulse; potentials; plane waves; wave packets; plane waves in matter; cavity resonators and wave guides; inhomogeneous wave equation; temporally oscillating sources and dipole radiation; accelerated point charges;</li> <li>6. Special Theory of Relativity: Lorentz transform; simultaneity; length contraction and time dilation; light cone; effect, energy and momentum; co- and contra-variant tensors; covariant classical mechanics;</li> <li>7. Covariant electrodynamics: Field strength tensor and Maxwell's equations; transformation of the fields; Doppler effect; Lorentz force</li> </ul>					
Intende	d learn	ning outcomes			
retical e penden	electroc tly app		ar with the correspor n and solution of pro	nding mathematical blems in this area.	They know the principles of theo- methods and are able to inde-
V (4) + Ü				in other than oenna	
		t in: Ü: German or English	1		
Method	of ass		nguage — if other tha		tion offered — if not every seme-
written	examir	nation (approx. 120 minu	tes)		
Langua	ge of a	ssessment: German and/	or English		
Allocati	on of p	laces			
Additio	nal info	ormation			
Workloa	ad				
240 h					
Teachin	g cvcle	2			
	3 - ,				
Referre	d to in	LPOI (examination regu	lations for teaching	legree programmec)	
Referre					
		•			
Module	appea	rs in			

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

Module title				Abbreviation		
Theoretical I	Mechanics			11-T-M-152-m01		
Module coor	dinator		Module offered by			
	rector of the Institute of 1	Theoretical Physics	Faculty of Physics a	and Astronomy		
and Astrophy		neoreticut nysies				
ECTS Meth	nod of grading	Only after succ. con	npl. of module(s)			
8 num	erical grade					
Duration	Module level	Other prerequisites				
1 semester	undergraduate			completion of exercise		
				nts who successfully o	•	
				admission to assess		
			lecturer will inform students about the respective details at the beginni			
		of the semester.				
Contents	formulation: Inertial system					
systems and 3. Hamiltonia Poisson brac Liouville the 4. Applicatio electromagn ring, cross se 5. Relativistic mics: Stabili <b>Intended lea</b> The students miliar with th dently apply to interpret t <b>Courses</b> (typ V (4) + Ü (2)	ical gauge transformatio apparent forces; an formulation: Legendre exets, canonical transforr orem; Hamilton-Jacobi fo ns: Central-force problen etic field; rigid bodies, to ection [optional]; c dynamics: Lorentz Trans ty theory; KAM theory [op <b>rning outcomes</b> s have gained first experi- the principles of theoretica the acquired mathematic he results. They have esp e, number of weekly cont ht in: Ü: German or Englis	transformation, phase nations; generator of s rmulation [optional]; ns; mechanical similar orque and inertia tenso sformation; Minkowsk otional]; deterministic ences concerning the al mechanics and their cal methods and techr becially acquired know tact hours, language –	e space; Hamilton fu symmetries, conserva- ity, Virial theorem; n or, centrifugal and Eu i space; equations o chaos [optional] working methods of r different formulatio hiques to simple prol-	nction, canonical equ ation laws; minimal co ninor vibrations; partio ler equations [optiona f motion; 6. Non-linea Theoretical Physics. Th ns. They are able to in blems of Theoretical P ematical concepts.	ations; oupling; cles in an al]; scatte- ar dyna- hey are fa- adepen-	
Method of as	ssessment (type, scope, tion on whether module	language — if other th		tion offered — if not e	very seme-	
written exam	ination (approx. 120 min assessment: German an	utes)				
Allocation of	places					
/ docution of						
 Additional in	formation					
Additional in Registration: this will be c 3 Sentence 4 find that the gistration for ly register for sessment wa sessment to	formation If a student registers for onsidered a declaration of ASPO (general academic student has obtained the r assessment into effect. r an assessment. Studen as not put into effect will which he/she has not be	of will to seek admissi c and examination reg e qualification for adm Only those students th ts who did not register not be admitted to the een admitted, the grad	on to assessment pu ulations). If the mod ission to assessmen nat meet the respect for an assessment of respective assessm	Irsuant to Section 20 S ule coordinators subs at, they will put the stu- ive prerequisites can so or whose registration f ent. If a student takes assessment will not be o	Subsection equently ident's re- successful- for an as- s an as-	

#### Workload

240 h

Teaching cycle

D

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

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## Module appears in

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

Module title					Abbreviation
Quantum Mechanics - Exercises					11-T-QA-152-m01
Module	e coord	inator		Module offered by	<u> </u>
		ector of the Institute of Th	neoretical Physics	Faculty of Physics a	and Astronomy
and Ast					
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
5	nume	rical grade			
Duratio		Module level	Other prerequisites		
1 seme	ster	undergraduate			completion of exercises (approx.
					nts who successfully completed
					admission to assessment. The espective details at the beginning
			of the semester.	students about the n	espective details at the beginning
Conten	te		of the semester.		
		uantum machanica area	ding to the sentent -	faa T CEV/ Amaria	there Ways function and Coher
					thers Wave function and Schrö- QM, one-dimensional problems,
					nent in the electromagnetic field,
additio	n of an	gular momenta, approxi	mation methods, ator	ns with several elect	trons, etc.
Intende	ed lear	ning outcomes			
					s and are able to independently
		the description and solu	ition of problems of q	uantum theory and	to interpret the results in a physi-
cal mar					<b>`</b>
	<b>s</b> (type	, number of weekly conta	ict hours, language –	- if other than Germa	in)
Ü (2) Module	taugh	t in: Ü: German or Englisl	h		
			-	an German, evamina	tion offered — if not every seme-
		on on whether module c			and oncice in not every serie
written	exami	nation (approx. 120 minu	ites)		
		ssessment: German and			
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
this wil 3 Sente find tha gistrati ly regis sessme sessme	l be co ence 4 / at the s on for a ter for a ent was ent to w	nsidered a declaration of ASPO (general academic tudent has obtained the assessment into effect. C an assessment. Students not put into effect will n	f will to seek admission and examination reg qualification for adm only those students the s who did not register ot be admitted to the	on to assessment pu ulations). If the mod ission to assessmen nat meet the respect for an assessment of respective assessm	n for admission to assessment, ursuant to Section 20 Subsection ule coordinators subsequently nt, they will put the student's re- ive prerequisites can successful- or whose registration for an as- tent. If a student takes an as- sessment will not be considered.
Worklo	ad				
150 h					
Teachi	ng cycl	е			
Referre	d to in	LPOI (examination regu	lations for teaching-o	degree programmes)	
Module	e appea	urs in			

Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021) exchange program Physics (2023)

Module title				Abbreviation
Quantum Mechanics and Statistical Physics				11-T-QS-152-m01
Module coordinator			Module offered by	
Managing Director of the Institute of Theoretical Physics			1	
and Astrophys		Ineoretical Physics	Faculty of Physics a	ina Astronomy
ECTS Metho	od of grading	Only after succ. cor	mpl. of module(s)	
6 nume	rical grade			
Duration	Module level	Other prerequisites	5	
2 semester	undergraduate			
Contents				
A. Quantum m 1. History and to quantum m 2. Wave functi- pulse measure tionary solution 3. Formalisations space and Dirace space and Dirace 4. Postulates 5. One-Dimensi- try properties; 6. Spin-1/2 sy two-level system 7. Angular mon- solution of the 8. Central pote 9. Motion in a mentum; Gauge motion of a free 10. Spin-1/2 sy time-depender 12. Approximation time-depender 13. Atoms with mic structure and time-depender 13. Atoms with mic structure and 14. Statistical P cro-states; procents 1. Statistical P closed and op 2. Ideal system 3. Statistical F ralised forces; 4. Thermodynam 5. Ideal System 5. Ideal S	principles; limits of cla echanics (QM); on and Schrödinger ec- ement; correspondence on of SG on of QM: Eigenvalue ec- ac notation; representa- of QM (and their interp sional problems: The h stems I: Theoretical de- ems (qubits); mentum: Commutation e eigenvalue equation ential - hydrogen atom n electromagnetic field ge transformation; Aha ee electron in a magne ystems II: Formulation f angular momenta; ition methods: Station nt perturbation theory n several electrons: Ide and Hund's rules; Physics and thermodyn of statistics: Elements of obability space (condit hysics: Entropy and pr en systems (with ener ns: Spin systems; line) hysics and thermodyn the second and third amics: Thermodynamic ic machines (Carnot er	quation (SG): SG for fre e principles: postulate equations; Physical sign ations in state space; t retation): state; measu armonic oscillator; pot escription in Dirac notat n and rotations; eigenv in polar coordinates (cr Bonding states in 3D; Hamiltonian operato pronov-Bohm effect; Sc tic field; using angular moment ary perturbation theory intical particles; heliun polar cossility, statis obability theory; entrop gy and / or particle exc ar oscillators; ideal gas amics: The 1st law; qua law; reversibility; trans c fundamentals relation ngine and efficiency); c cs: Systems of identica	e particles; superpos s of QM; Ehrenfest the nificance of the eiger ensor products of sta- urement; chronologic tential level; potentia tion; Spin 1/2 in the l alues of the angular oncrete); Coulomb potential; r; Normal Zeeman eff hrödinger, Heisenbe tum algebra; r (with examples); va n atom; Hartree and H hit theorem and statis stical independence) py in classical physic hange); s; asi-static processes; ition from Statistical nship; thermodynam hemical potential; il particles; ideal Ferr	al development; energy-time un- al barrier; potential well; symme- homogeneous magnetic field; momentum operators (abstract); fect; canonical and kinetic mo- rg and interaction representation riational method; WKB method; Hartree-Fock approximation; ato-

Bachelor's with 1 major Nanostructure Technology	JMU Würzburg • generated 18-Apr-2025 • exam. reg. da-	page 144 / 150
(2015)	ta record Bachelor (180 ECTS) Nanostrukturtechnik - 2015	

7. Critical phenomena: Scaling laws, critical slowing down, fast variable as Bad (electron-phonon interaction and BCS superconductivity); magnetism (quantum criticality at low temperatures, quantum phase transitions at T = o); problems of the thermodynamic limit

#### Intended learning outcomes

The students have knowledge of the methods of Theoretical Physics. They know the principles of mechanics, Statistical Physics and thermodynamics. They are able to discuss the acquired theoretical concepts and to attribute them to bigger physical contexts.

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

V (4) + V (4)

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

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

## Allocation of places

--

#### Additional information

--

Workload

180 h

Teaching cycle

--

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

--

#### Module appears in

Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021) exchange program Physics (2023)

Module					Abbreviation
Statist	ical Ph	ysics - Exercises			11-T-SA-152-m01
Module	e coord	inator		Module offered by	
		ector of the Institute of Th	eoretical Physics	Faculty of Physics a	and Astronomy
and As			reoreticat i frysics		and Astronomy
ECTS	1	od of grading	Only after succ. con	npl. of module(s)	
5	nume	rical grade		-	
Duratio	'n	Module level	Other prerequisites	;	
1 seme	ster	undergraduate			
Conten	ts		,		
Among potenti	others ials, qu	Principles of statistics, S	Statistical Physics, id	eal systems, fundam	e content of 11 T-SEV content. nental theorems, thermodynamic cles, approximation methods,
Intende	ed lear	ning outcomes			
and are	e able t		nem to the descriptio		dynamics and Statistical Physics blems of Statistical Physics and
Course	<b>s</b> (type	, number of weekly conta	act hours, language –	– if other than Germa	an)
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Module	e taugh	t in: Ü: German or Englis	h		
		s <b>essment</b> (type, scope, la on on whether module c			ition offered — if not every seme
		nation (approx. 120 minu ssessment: German and			
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
Worklo	ad				
150 h					
Teachi	ng avel	0			
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Kererre	a to in	LPOI (examination regu	liations for teaching-	uegree programmes;	
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Bachel					
Bachel Bachel	or's de	gree (1 major) Nanostruc	ture Technology (201	5)	
Bachel Bachel Bachel	or's de or's de	gree (1 major) Nanostruc gree (1 major) Mathemat	ture Technology (201 ical Physics (2015)	5)	
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Dringin	e title			Abbreviation	
rmup	oles of Two- and Three-Dimens	ional Röntgen Imagin	g	11-ZDR-152-m01	
Modul	e coordinator		Module offered by	<u> </u>	
Manag	ging Director of the Institute of <i>I</i>	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Method of grading	Only after succ. co	mpl. of module(s)		
6	numerical grade				
Duratio	on Module level	Other prerequisites	S		
1 seme	ester graduate				
Conter	nts				
ton ab project traction charac	s of X-ray generation (X-ray tub sorption, scattering), physics o tion, Fourier reconstruction, ite n, visualisation,). Applicatio terisation, metrology, biology,	f X-ray detection. Mat rative methods). Imag ns of X-ray imaging in	hematics of reconstruge processing (image the industrial sector	uction algorithms (fil data pre-processing (component testing,	ltered rear , feature ex- , material
	ed learning outcomes		<b>C</b> (1) <b>C</b> (1		
	udents know the principles of g ques using X-rays and methods				
	es (type, number of weekly con				.11005.
V (3) +		iaci nouis, language -		III <i>)</i>	
	e taught in: German or English				
	<b>d of assessment</b> (type, scope, iformation on whether module			tion offered — if not	every seme-
	examination in groups (groups	of 2 approx 20 mini			
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Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Functional Materials (2022) exchange program Physics (2023) Master's degree (1 major) Functional Materials (2025)

Module	e title			Abbreviation
Method	ds of Non-Destructive Materia	al Testing		11-ZMB-152-m01
Module	coordinator		Module offered by	
Managing Director of the Institute of A		Applied Physics	Faculty of Physics a	and Astronomy
ECTS	Method of grading	Only after succ. co	- · · · · · · · · · · · · · · · · · · ·	and Astronomy
4	numerical grade			
 Duratio		Other prerequisite	6	
1 seme			5	
Conten				
				la star a dia ama ka Yana ta di
	und. Optical testing, laser. Im		ing. inermography. N	leutron radiography. X-ray testi
	ed learning outcomes	lage processing.		
	dents have basic knowledge	of the concretion and	intoraction process	a of different turned of redicti
on (hea thods f	at, X-ray, terahertz), particles	(neutrons) or ultrasour ypes, particles and ult	nd waves with materi	als. They know the applied me- are able to apply them to basic
Course	<b>s</b> (type, number of weekly cor	ntact hours, language	— if other than Germa	an)
V (2) + Module	R (1) e taught in: German or English	1		
				ation offered — if not every sem
ster, in	formation on whether module	e can be chosen to ear	n a bonus)	
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b) oral c) oral c d) proje e) prese If a writ stead ta of asse nation Langua	examination of one candidate examination in groups (group ect report (approx. 8 to 10 pag entation/talk (approx. 30 min tten examination was chosen ake the form of an oral exami ssment is changed, the lectur date at the latest. ge of assessment: German ar	e each (approx. 30 min is of 2, approx. 30 min ges) or jutes). as method of assessm nation of one candidat rer must inform studer nd/or English	utes per candidate) o nent, this may be cha te each or an oral exa	r nged and assessment may in- mination in groups. If the meth weeks prior to the original exa
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