

Subdivided Module Catalogue for the Subject

Functional Materials

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

Examination regulations version: 2022 Responsible: Faculty of Medicine Responsible: Faculty of Chemistry and Pharmacy Responsible: Responsible: Faculty of Physics and Astronomy Responsible: University of Applied Sciences Würzburg- Schweinfurt (FHWS)



Learning Outcomes

German contents and learning outcome available but not translated yet.

Wissenschaftliche Befähigung

- Die Absolventinnen und Absolventen können ein breites und vertieftes interdisziplinäres Wissen aus den wichtigsten Disziplinen der Materialwissenschaften abrufen. Die Absolventinnen und Absolventen verstehen die mathematischen, theoretischen und experimentellen Grundlagen der Materialwissenschaften und können diese selbständig anwenden. Sie besitzen Abstraktionsvermögen, analytisches Denken, Problemlösungskompetenz und die Fähigkeit, komplexe Zusammenhänge zu strukturieren. Die Grundlagen hierfür werden in Vorlesungen und Übungen der Chemie, Mathematik und Physik vermittelt und mittels Klausuren überprüft.
- Die Absolventinnen und Absolventen können selbständig Experimente durchführen, analysieren und die erhaltenen Ergebnisse darstellen und bewerten. Vermittelt werden diese Fähigkeiten im Rahmen der Projektarbeiten. Die Überprüfung der Zielerreichung findet durch die Erstellung einer Projektarbeit und deren Präsentation mit anschließender Diskussion statt.
- Die Absolventinnen und Absolventen sind in der Lage, sich mit Hilfe von Fachliteratur in neue komplexe interdisziplinäre Aufgabengebiete selbständig einzuarbeiten, naturwissenschaftliche Methoden selbständig auf konkrete experimentelle oder theoretische Aufgabenstellungen anzuwenden, Lösungswege zu entwickeln und die Ergebnisse zu interpretieren und zu bewerten. Auch diese Fähigkeiten werden im Rahmen Projektarbeiten sowie der Masterarbeit entwickelt und durch die anschließende Bewertung der Arbeit überprüft. Die Absolventinnen und Absolventen können darüber hinaus ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darstellen und vertreten, was durch das Abschlusskolloquium zur Masterarbeit überprüft wird.

Befähigung zur Aufnahme einer Erwerbstätigkeit

- Die Absolventinnen und Absolventen können mit wissenschaftlichen Methoden auch unbekannte Probleme aus unterschiedlichen fachlichen Perspektiven analysieren und bearbeiten. Der interdisziplinäre Aufbau des Studiengangs, der Elemente aus mathematisch-, ingenieurund naturwissenschaftlichen Fachbereichen vereint, fördert von Beginn an interdisziplinäres Lernen, Denken und Verstehen. Dies wird durch den Besuch von Lehrveranstaltungen der Physik, Mathematik und Chemie vermittelt und durch die erfolgreiche Absolvierung der Module bestätigt. Diese Problemlösungskompetenz können die Absolventinnen und Absolventen gewinnbringend in ihrer Berufspraxis einsetzen.
- Die Absolventinnen und Absolventen sind darüber hinaus in der Lage, theoretisches Wissen in der Praxis anzuwenden. Der Praxisbezug ist durch die eingangs genannten Kooperationspartner gegeben, sodass die Studierenden in Rahmen von Vorlesungen und Laborpraktika bereits im Bachelorstudium Kontakt zu praxisorientierten außeruniversitären Forschungseinrichtungen haben. Im Masterstudium können die Studierenden ihre Projektarbeiten in diesen Einrichtungen anfertigen, sodass ein direkter Praxisbezug der Forschung gegeben ist. Überprüft wird diese Fähigkeit durch Projektarbeiten und nicht zuletzt die Abschlussarbeit.
- Die Absolventinnen und Absolventen können unterschiedliche Aufgaben parallel und unter Zeitund Erfolgsdruck auch bei widrigen Rahmenbedingungen erfolgreich bearbeiten. Diese Fähigkeit wird durch die Prüfungsdichte am Ende der Vorlesungszeit erlernt und befähigt die Absolventinnen und Absolventen auch im stressigen Berufsalltag Aufgaben erfolgreich zu bearbeiten.
- Absolventinnen und Absolventen sind in der Lage, konstruktiv und zielorientiert in einem heterogenen Team zusammenzuarbeiten, unterschiedliche und abweichende Ansichten produktiv zur Zielerreichung zu nutzen und auftretende Konflikte zu lösen. Diese Teamfähigkeit und Konfliktkompetenz erlernen die Studierenden in der Zusammenarbeit in Arbeitskreisen während der Anfertigung der Projekt- und Abschlussarbeit.

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UNIVERSITÄT WÜRZBURG

Persönlichkeitsentwicklung

- Die Absolventinnen und Absolventen sind bereit und in der Lage, Verantwortung für ihr Handeln und für andere zu übernehmen. Die Absolventinnen und Absolventen verfügen über die kommunikativen Fähigkeiten, komplexe Sachverhalte und Standpunkte im Team zu entwickeln, zielgruppengerecht darzustellen und reflektiert gegenüber abweichenden Positionen zu verteidigen und weiterzuentwickeln. Diese Fähigkeiten, zur Übernahme von Verantwortung, Diskussionsbereitschaft und Teamfähigkeit sowie Eigenverantwortung und Selbständigkeit erlernen und beweisen die Studierenden durch die Anfertigung der Projekt- und Abschlussarbeiten, deren Zielerreichung mit der Bewertung der Arbeit überprüft wird.
- Erst die durch Einübung und Ermutigung erlangte Fähigkeit zur Kritik und Reflexion (inklusive Selbstreflexion und Selbstkritik) ermöglicht eigenständiges Denken und selbstbestimmtes Handeln, das vor sich selbst und anderen begründet ist und rational kommuniziert werden kann. Diese Kritikfähigkeit und Fähigkeit zur Selbstreflexion erlernen die Studierenden mittels Feedbacks durch Lehrende und Studierende zu ihrem Vortrag in Seminaren, die vermehrt im Masterstudium stattfinden.

Gesellschaftliches Engagement

• Die Absolventinnen und Absolventen haben ihr Wissen bezüglich wirtschaftlicher, gesellschaftlicher und naturwissenschaftlicher Fragestellungen erweitert und können begründet Position beziehen. Durch die Behandlung aktueller Forschungsthemen in den Lehrveranstaltungen werden Bezüge zu wirtschaftlichen und gesellschaftlichen Fragestellungen hergestellt. Darüber hinaus können die Absolventinnen und Absolventen gesellschaftliche, naturwissenschaftliche, kulturelle wie auch wirtschaftliche Entwicklungen kritisch reflektieren und deren Auswirkungen auf die Wirtschaft, Gesellschaft und die Umwelt erfassen. Im Rahmen der Projektarbeiten sowie der Masterarbeit befassen sich die Studierenden mit aktuellen gesellschaftlich und wirtschaftlich relevanten materialwissenschaftlichen Fragestellungen, deren Kenntnisse sowie die Fähigkeit begründet Position zu beziehen im Kolloquium überprüft werden.

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)):

22-Mar-2022 (2022-9)

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

Abbraviation		ECTS	Method of			
Addreviation	Module lille	credits	grading	page		
Compulsory Courses (40 E	CTS credits)					
11-FU-MTE-161-m01	Mechanical and Thermal Material Properties	5	NUM	79		
11-FU-MOE-161-m01	Opto-Electronic Material Properties	5	NUM	78		
o8-FU-MaWi3-222-mo1 Materials Science 3		5	NUM	24		
08-0CM-FM-161-m01	Organic Functional Materials	5	NUM	34		
08-FU-PR1-161-m01	Research Project 1	10	NUM	28		
08-FU-PR2-161-m01	Research Project 2	10	NUM	29		
Compulsory Electives (50 l	ECTS credits)					
Subfield Focus Topic (30	ECTS credits)					
Two focus topics are to be	e selected, from which modules of 15 ECTS credits each are to be	e complete	d.			
Focus Topic I: Functiona	l Materials in Biology and Medicine (15 ECTS credits)					
03-BIOPOL-222-m01	Biopolymers	5	NUM	11		
03-BIOFAB-222-m01	Biofabrication	5	NUM	10		
03-FU-IMPL-222-m01	Functional Materials in Implantology	5	NUM	13		
03-FU-DDEL-222-m01	Nano4Med	5	NUM	12		
o3-GEWMAT-222-mo1 Tissue cells meet materials		5	NUM	15		
Focus Topic II: Polymer Functional Materials (15 ECTS credits)						
03-BIOFAB-222-m01	Biofabrication	5	NUM	10		
08-FU-PW1-161-m01	Polymer Materials 1: Technology of Polymer Modification	5	NUM	30		
03-ADFER-222-m01	2-mo1 Additive Manufacturing		NUM	9		
on ELL DWo 464 mot	Polymer Materials 2: Technology of Filler Modification for Poly-	_	NILIAA	24		
08-FU-PW2-161-m01 mer Materials		5	NOM	31		
03-FU-PM2-222-m01	Polymers II	5	NUM	14		
Focus Topic III: Energy Technologies (15 ECTS credits)						
08-FU-EEW-222-m01	Electrochemical Energy Storage and Conversion	5	NUM	22		
08-EU-MW-222-m01	Structure-Properties Correlations of Light Materials - Experi-	F	NILIM	26		
08-10-10101	ments and Numerical Simulations	5	NOM	20		
00-HIS-222-m01	Materials for High Voltage insulation and High Voltage Sy-	F	NIIM	104		
991115 222 11101	stems	5	Nom	104		
11-NTE-152-m01	Nanotechnology in Energy Research	6	NUM	90		
11-ENT-152-m01	Principles of Energy Technologies	6	NUM	74		
11-HNS-161-m01	Optical Properties of Semiconductor Nanostructures	6	NUM	82		
Focus Topic IV: Semiconductor Nanostructures (15 ECTS credits)						
11-HPH-201-m01	Semiconductor Physics	6	NUM	84		
11-SPD-152-m01	Physics of Semiconductor Devices	6	NUM	98		
11-OHL-161-m01	11-OHL-161-mo1 Organic Semiconductors		NUM	92		
11-BVG-202-m01	Coating Technologies based on Vapour Deposition	5	NUM	67		
11-HNS-161-m01	Optical Properties of Semiconductor Nanostructures	6	NUM	82		
Focus Topic V: Organic I	Functional Materials and Applications (15 ECTS credits)					
08-FU-NT-AA-152-m01	Chemical Nanotechnology: Analytics and Applications	5	NUM	27		
08-FU-PW1-161-m01	Polymer Materials 1: Technology of Polymer Modification	5	NUM	30		
08-PCM3-161-m01	Nanoscale Materials	5	NUM	42		

08-FU-PW2-161-m01	5	NUM	31	
08-SCM1-161-m01	Supramolecular Chemistry (Basics)	5	NUM	48
08-PCM5-161-m01	Physical Chemistry of Supramolecular Assemblies	5	NUM	46
Focus Topic VI: Imaging	und Spectroscopy (15 ECTS credits)			
11-ZDR-152-m01	Principles of Two- and Three-Dimensional Röntgen Imaging	6	NUM	100
11-CTA-212-m01	Advanced Computer Tomography	6	NUM	70
11-EIM-211-m01	Electron and Ion Microscopy	6	NUM	72
08-PCM1a-161-m01	Laser Spectroscopy	5	NUM	38

Subfield General Compulsory Electives (20 ECTS credits)

The 20 ECTS points can be taken from the following modules.

Alternatively, within these 20 ECTS credits, modules of the "Subfield Focus Topic (I to V)" can also be completed, whereby the modules already taken in the selected "Subfield Focus Topic" and introduced there cannot be used again in the "Subfield General Compulsory Electives".

Module Group Material Sciences						
08-FU-SGC-222-m01	Sol-Gel Che	emistry	3	NU	М	32
08-FU-ANA-161-m01	Analytical I	Methods - Examples from Practical Failure Analysis	5	NU	М	20
Module Group Physics						
11-SPD-152-m01	Physics of	Semiconductor Devices	6	NU	Μ	98
11-HLF-152-m01	Semicondu	conductor Lasers and Photonics		NU	Μ	80
11-QTH-161-m01	Quantum T	m Transport		NU	Μ	96
11-ZMB-152-m01	Methods o	f Non-Destructive Material Testing	4	NU	М	102
11-LMT-152-m01	Laboratory	and Measurement Technology	6	NU	М	88
11-BMT-161-m01	Biophysica	l Measurement Technology in Medical Science	6	NU	М	63
11-HPH-201-m01	Semicondu	ictor Physics	6	NU	М	84
11-ZDR-152-m01	Principles of	of Two- and Three-Dimensional Röntgen Imaging	6	NU	М	100
11-PMM-161-m01	Physics of <i>i</i>	Advanced Materials	6	NU	М	94
11-LMB-152-m01	Laboratory	and Measurement Technology in Biophysics	6	NU	М	86
11-CMS-161-m01	Computatio	omputational Materials Science (DFT)		NU	М	68
11-FK2-201-m01	Solid State	olid State Physics 2		NU	М	76
11-BMS-152-m01	maging Methods at the Synchroton		6	NU	М	61
11-BSV-161-mo1 Image and Signal Processing in Physics			6	NU	М	65
Module Group Chemistry						
08-SCM3-152-m01	Bioorganic	anic Chemistry		NU	М	49
08-BC-MOLMC-161- m01	Molecular I	ular Biology for Advanced Students		NU	M	18
08-OCM-SYNT-161-mo1	Modern Sy	nthetic Methods	5	NU	М	36
08-PCM4-161-m01	Ultrafast sp	ltrafast spectroscopy and quantum-control		NU	М	44
08-PCM2-161-m01	Statistical	Mechanics and Reaction Dynamics	5	NU	М	40
Module Group Theory of Chemistry / Numerics (Mathematics / Computer Science)						
08-TCM2-161-m01	Basics and Applications of Quantum Chemistry		5	NU	М	53
08-TCM3-161-m01	Numerical Methods and Programming		5	NU	М	55
08-TCM4-161-m01	Quantum Dynamics		5	NU	М	57
08-TCM1-161-m01	Selected Topics in Theoretical Chemistry		5	NU	М	51
10-I-PP-152-m01	Practical Co	actical Course in Programming		B/N	IB	59
10-M-MWR-222-m01	Modelling	elling and Computational Science 10 N			М	60
Module Group Biology						
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		ta record master (120 ECTS) Funktionswerkstoffe	2022			

07-4S1MOLB-152-mo1 Aspects of Molecular Biotechnology 5 NUM						
Module Group Biology						
08-FU-AP-222-m01	Foreign Studies	5	B/NB	21		
08-FU-ALS-222-m01	Foreign Studies with a focus on Materials Science	5	B/NB	19		
08-FU-ST-222-m01	Special Topics of Materials Science	5	B/NB	33		
Module Group Focus To	pic I: Functional Materials in Biology and Medicine					
03-BIOPOL-222-m01	Biopolymers	5	NUM	11		
03-BIOFAB-222-m01	Biofabrication	5	NUM	10		
03-FU-IMPL-222-m01	5	NUM	13			
03-FU-DDEL-222-m01	Nano4Med	5	NUM	12		
03-GEWMAT-222-m01 Tissue cells meet materials 5 NUM 15						
Module Group Focus To	pic II: Polymer Functional Materials					
03-BIOFAB-222-m01 Biofabrication			NUM	10		
08-FU-PW1-161-m01	Polymer Materials 1: Technology of Polymer Modification	5	NUM	30		
03-ADFER-222-m01	Additive Manufacturing	5	NUM	9		
09 ELL DW/2 161 mo1	Polymer Materials 2: Technology of Filler Modification for Poly-	F	NILIAA	21		
08-FU-PW2-161-1101	mer Materials	5	NUM	31		
03-FU-PM2-222-mo1 Polymers II			NUM	14		
Module Group Focus Top	pic III: Energy Technologies					
08-FU-EEW-222-m01	Electrochemical Energy Storage and Conversion	5	NUM	22		
08-FU-MW-222-m01	Structure-Properties Correlations of Light Materials - Experi-	F	NUM	26		
	ments and Numerical Simulations	J				
00-HIS-222-m01	Materials for High Voltage insulation and High Voltage Sy-	5	NUM	10/		
	stems			104		
11-NTE-152-m01	NTE-152-mo1 Nanotechnology in Energy Research			90		
11-ENT-152-mo1 Principles of Energy Technologies			NUM	74		
11-HNS-161-mo1Optical Properties of Semiconductor Nanostructures6NUM82						
Module Group Focus Topic IV: Semiconductor Nanostructures						
11-HPH-201-m01	Semiconductor Physics	6	NUM	84		
11-SPD-152-m01	Physics of Semiconductor Devices	6	NUM	98		
11-OHL-161-m01	Organic Semiconductors	6	NUM	92		
11-BVG-202-m01	Coating Technologies based on Vapour Deposition	5	NUM	67		
11-HNS-161-m01	Optical Properties of Semiconductor Nanostructures	6	NUM	82		
Module Group Focus Topic V: Organic Functional Materials and Applications						
08-FU-NT-AA-152-m01	Chemical Nanotechnology: Analytics and Applications	5	NUM	27		
08-FU-PW1-161-m01	Polymer Materials 1: Technology of Polymer Modification		NUM	30		
08-PCM3-161-m01	Nanoscale Materials	5	NUM	42		
Polymer Materials 2: Technology of Filler Modification for Poly-		г	NITIW	21		
00-10-1 W2-101-1101	mer Materials		NOM	51		
08-SCM1-161-m01	08-SCM1-161-mo1 Supramolecular Chemistry (Basics)		NUM	48		
08-PCM5-161-m01	Physical Chemistry of Supramolecular Assemblies	5	NUM	46		
Module Group Focus To	pic VI: Imaging und Spectroscopy					
11-ZDR-152-m01	Principles of Two- and Three-Dimensional Röntgen Imaging	6	NUM	100		
11-CTA-212-m01	Advanced Computer Tomography	6	NUM	70		
11-EIM-211-m01	Electron and Ion Microscopy	6	NUM	72		
08-PCM1a-161-m01	Laser Spectroscopy	5	NUM	38		
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Thesis (30 ECTS credits)				
08-FU-MT-161-m01	Master Thesis Functional Materials	25	NUM	25
08-FU-Koll-161-m01	Master Thesis Defense	5	NUM	23

Module title			Abbreviation		
Additive Manufacturing	03-ADFER-222-m01				
Module coordinator		Module offered by			
holder of the Chair of Functional Mater Dentistry	ials in Medicine and	Chair of Chemical T	echnology of Material Synthesis		
ECTS Method of grading	Only after succ. com	pl. of module(s)			
5 numerical grade		• • • •			
Duration Module level	Other prerequisites				
1 semester					
Contents					
The course will cover the basics of additive manufacturing (AM) focusing on the techniques and materials used in AM. All aspects of the 3D printing chain, starting from the CAD design followed by slicing, printer selection and preparation to post processing, will be discussed. Participants will get the possibility to have hand-on experi- ence with different printing methods during practical sessions. Based on current examples, options to transfer the process from prototyping to manufacturing and concepts to implements sustainability into additive manufac- turing will be highlighted. The course will also focus on biomedical applications and options how 3D printing can					
Intended learning outcomes					
The student has advanced knowledge	of the synthesis, mod	lification and charac	terization of polymers.		
Courses (type, number of weekly contact hours, language — if other than German)					
V (2) + Ü (1) + P (1) Module taught in: V, Ü: 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)					
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) talk (approx. 30 minutes) Language of assessment: English					
Allocation of places					
Additional information					
Workload					
150 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Master's degree (1 major) Functional N	laterials (2022)				
Master's degree (1 major) Functional N	laterials (2025)				

Module title			Abbreviation			
Biofabrication			03-BIOFAB-222-m01			
Module coordinator Module offered by			· · · · · · · · · · · · · · · · · · ·			
holder	of the (Chair of Functional Materi	ials in Medicine and	Faculty of Medicine		
Dentist	ry					
ECTS	Metho	od of grading	Only after succ. com	ipl. of module(s)		
5 Duratio	nume	Madula laval	 Other prerequisites			
1 seme	ster	graduate				
Conten	ts	3.444440				
Definitions within biomaterials, tissue engineering and biofabrication, overview of medical device regulations and practices, description of extracellular matrix, bioprinting, continuous liquid interface polymerisation, two- photon polymerisation, fused deposition modelling, inorganic powder printing, stereolithography, selective laser sintering, melt electrospinning writing, self-healing hydrogels, polymers in 3D printing, introduction to rheology, scientific method and reproducibility, digital signal generation and quality control.						
Studen ble in th printer ding of will acq biomed	Students gain a thorough appreciation of the different additive manufacturing (3D printing) technologies available in the context of biofabrication. This includes how the polymers are processed and how each class of 3D printer works, with its strengths and weaknesses. A holistic view of biofabrication is taught, with an understanding of scientific methodology for each stage and the different regulations governing medical devices. Students will acquire the necessary skills to critique and develop opinions on the 3D printing industry and the resulting biomedical applications.					
Courses (type, number of weekly contact hours, language — if other than German)						
V (2) + Module	U (1) + e taugh	P (1) t in: V, Ü: English				
Method ster, inf	l of ass formati	s essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) talk (approx. 30 minutes) Language of assessment: English						
Allocat	ion of p	olaces				
Additional information						
Workload						
150 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	appea	irs in				
Master'	s degr	ee (1 major) Functional M	aterials (2022)			
Master's degree (1 major) Functional Materials (2025)						

Module title				Abbreviation	
Biopolymers			03-BIOPOL-222-m01		
Module	e coord	inator		Module offered by	
holder	ofthe	Chair of Macromolecular (Chemistry	Faculty of Medicine	
ECTS	Methe	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster				
Conten	ts				
Organis form (s se natu cations which a	sms pro urvival Irally o In ad are incr	oduce biologically active) important functions in s ccurring polymers can als dition, novel macromolec reasingly used as sustain	macromolecules (pol tructure, movement, o be isolated, chemic ules can additionally able and degradable	ysaccharides, protei recognition, metabo cally modified and co be synthetically der biopolymers.	ins, nucleic acids, etc.) that per- lic and information storage. The- ommercialized for further appli- ived from bio-based feedstocks,
Intende	ed lear	ning outcomes			
The stu on, mo	ident w dificati	ill acquire fundamental k on, and application in va	nowledge of naturall rious biological conte	y occurring macromo exts and everyday ar	blecules, their production, functi- eas.
Course	s (type	, number of weekly conta	ct hours, language —	· if other than Germa	n)
V (2) + Ü (1) + P (1) Module taught in: V, Ü: 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)					
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) talk (approx. 30 minutes) Language of assessment: English					
Allocat	ion of I	places			
 Additional information					
Workload					
150 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Master's degree (1 major) Functional Materials (2022)					
Master's degree (1 major) Chemistry (2024)					
Master	's teac	hing degree Gymnasium I	WINT Teacher Educati	ion PLUS, Elite Netwo	ork Bavaria (ENB) (2025)
Supple	menta	ry course MINT Teacher E	ducation PLUS, Elite N	Network Bavaria (EN	B) (2025)
Master	's degr	ee (1 major) Functional M	aterials (2025)		

Module title				Abbreviation		
Nano4Med					03-FU-DDEL-222-m01	
Module	e coord	inator		Module offered by		
holder Dentist	of the (ry	Chair of Functional Materi	ials in Medicine and	Chair of Chemical T	echnology of Material Synthesis	
ECTS	Methe	od of grading	Only after succ. con	pl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster					
Conten	ts					
Incorpo stems f	oration for tran	and Conjugateion of activ sport, targeting and relea	ve substances into paise of active ingredie	article systems, func nts.	tionalization of the particle sy-	
Intende	ed lear	ning outcomes				
Incorpo stems f	oration for tran	and Conjugateion of activ sport, targeting and relea	ve substances into p use of active ingredie	article systems, func nts.	tionalization of the particle sy-	
Course	s (type	, number of weekly conta	ct hours, language –	· if other than Germa	n)	
V (1) +	Ü (1) +	P (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) placement report / fieldwork report / report on practical training / report on practical course / project report / report on technical course (approx. 10 pages) and b) presentation (approx. 30 minutes) or written examination (approx. 90 minutes)						
Allocation of places						
Additional information						
Workload						
150 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master	's degr	ee (1 major) Functional M	aterials (2022)			
Master	's degr	ee (1 major) Chemistry (2	024)			
Master	's teac	hing degree Gymnasium I	WINT Teacher Educat	on PLUS, Elite Netwo	ork Bavaria (ENB) (2025)	
Supple	menta	ry course MINT Teacher Ed	ducation PLUS, Elite I	Network Bavaria (EN	B) (2025)	
Master	Master's degree (1 major) Functional Materials (2025)					

Module title Abbreviation						
Functional Materials in Implantology 03-FU-IMPL-222-m01						
Module coord	linator		Module offered by			
holder of the Chair of Musculoskeletal Tissue Regeneration Chair of Chemical Technology of Material Syn						
ECTS Meth	od of grading	Only after succ. com	pl. of module(s)			
5 nume	rical grade					
Duration	Module level	Other prerequisites				
1 semester						
Contents						
Anatomy and as well as pat medical impla	physiology of the cardiov hological processes lead ants in the respective area	ascular system, sens ing to functional impa a.	ory organs, skeletal airment or even loss	system, jaw incl. tooth structure of function. Materials and use of		
Intended lear	ning outcomes					
Students rece processes that cation of impl	ive in-depth basic knowle at can lead to the use of m ants in various organs an	edge in human physio nedical materials and nd tissues and their co	ology. They will also implants. The stude ompatibility and inte	gain knowledge of pathological ents have knowledge of the appli- eraction with the organism.		
Courses (type	, number of weekly conta	ct hours, language —	if other than Germa	n)		
V (3) + P (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) report on w b) presentatio c) written exa Language of a	a) report on work placement (approx. 10 pages) or b) presentation (approx. 30 minutes) or c) written examination (approx. 60 minutes) Language of assessment: German and/or English					
Allocation of	places					
Additional information						
Workload						
150 h						
Teaching cycle						
···						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appea	Module appears in					
Master's degr	ee (1 major) Functional M	aterials (2022)				
Master's degr	ee (1 major) Functional M	aterials (2025)				

Module title			Abbreviation			
Polymers II					03-FU-PM2-222-m01	
Module	e coord	inator		Module offered by		
holder Dentist	of the (ry	Chair of Functional Materi	ials in Medicine and	Chair of Chemical To	echnology of Material Synthesis	
ECTS Method of grading Only after succ. compl. of module(s)						
5	nume	rical grade				
Duration Module level Other prerequisites						
1 seme	ster	graduate				
Conten	ts					
Basics racteriz	as well ation.	as advanced knowledge	about contemporary	issues of polymer sy	ynthesis, -modification and cha-	
Intende	ed learr	ning outcomes				
The stu	dent ha	as advanced knowledge (of the synthesis, moc	lification and charac	terization of polymers.	
Course	s (type,	number of weekly conta	ct hours, language —	if other than Germa	n)	
V (2) +	P (2)					
Methoo ster, inf	l of ass formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) talk (approx. 30 minutes) Language of assessment: German and/or English Assessment offered: Once a year, winter semester creditable for bonus						
Allocal		naces				
Additio	nal Info					
 Worklo	ad					
150 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Functional Materials (2022) 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) Master's degree (1 major) Biofabrication (2025) Master's degree (1 major) Eventianal Materials (2022)						
Master's degree (1 major) Functional Materials (2025)						

Module title					Abbreviation		
Tissue cells meet materials					03-GEWMAT-222-m01		
Module	e coord	inator		Module offered by			
holder Medici	of the (ne	Chair of Tissue Engineerir	ng and Regenerative	Chair of Chemical T	echnology of Material Synthesis		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
5	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster						
Conten	ts						
The mo al tissu the use of cell- GLP, GI	odule te les (tiss e of suc based t MP, etc	eaches the following cont sue or also bioengineerin h models as alternative t rransplants, medical devi .).	ents: The cell culture g), the basics of cons est systems to anima ces and drugs, as we	techniques requirec structing such model Il experimentation. A Il as the regulatory b	l for the construction of artifici- s using suitable (bio)materials, nother topic is the development basis for their approval (REACH,		
Intend	ed lear	ning outcomes					
Studen well as	ts will the us	gain content-related and e of these tissues as sub	methodological insig stitutes for animal mo	thts into current key odels or as transplar	topics in tissue engineering as Its in regenerative medicine.		
Course	s (type	, number of weekly conta	ct hours, language –	· if other than Germa	n)		
V (2) +	P (2)						
Metho ster, in	d of ass formati	s essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
a) plac report (approz Langua	ement on tech x. 90 m ige of a	report / fieldwork report , nical course (approx. 10 inutes) ssessment: German and,	<pre>/ report on practical t pages) and b) presen /or English</pre>	raining / report on p tation (approx. 30 m	ractical course / project report / inutes) or written examination		
Allocat	ion of p	olaces					
Additio	onal inf	ormation					
Worklo	ad						
150 h							
Teaching cycle							
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	Module appears in						
Master	Master's degree (1 major) Functional Materials (2022)						
Master	Master's degree (1 major) Biofabrication (2025)						
Master	Master's degree (1 major) Functional Materials (2025)						

Module title				Abbreviation	
Aspect	s of Molecu	07-4S1MOLB-152-m01			
Module	e coordinate	or		Module offered by	<u> </u>
holder	of the Chaiı	r of Biotechnology an	d Biophysics	Faculty of Biology	
ECTS	Method of	grading	Only after succ. com	pl. of module(s)	
5	numerical	grade			
Duratio	on Mo	dule level	Other prerequisites		
1 seme	ster und	lergraduate			
Conten	ts				
Fundan mes, pi sor des electro	nental prind roduction o sign, drug d manipulatio	ciples of "white" biot f biomolecules, mole esign, drug targeting on of cells.	echnology, bioreacto ecular biology, recom , molecular diagnost	rs, biocatalysis, imm binant DNA technolo ics, recombinant ant	nobilisation of cells and enzy- ogy, protein engineering, biosen- ibodies, hybridoma technology,
Intende	ed learning	outcomes			
Studen ges and Studen dently to inde	ts will gain d disadvant ts will acqu review relev pendently a	an overview of tradit tages. They will learn tire a knowledge of fu vant literature. In add acquaint themselves	ional and modern me to decide what meth undamental methods lition, they will becor with - relevant mech	ethods in biotechnol 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
Course	$\frac{s}{c}$ (type, nur	nder of weekly conta	ict nours, language –	- If other than Germa	in)
Method ster, in written credita	d of assessi formation o examinatio ble for boni	ment (type, scope, la on whether module ca on (approx. 30 to 60 i us	nguage — if other tha an be chosen to earn minutes)	an German, examina a bonus)	tion offered — if not every seme-
Allocat	ion of place	25			
25 places. Should the number of applications exceed the number of available places, places will be allocated as follows: Students of the Bachelor's degree subject Biologie (Biology) with 180 ECTS credits will be given preferential con- sideration. Should the module be used in other subjects, there will be two quotas: 95% of places will be alloca- ted to students of the Bachelor's degree subject Biologie (Biology) with 180 ECTS credits and 5% of places (a mi- nimum of one place in total) will be allocated to students of the Bachelor's degree subject Biologie (Biology) with 60 ECTS credits and to students of the Bachelor's degree subjects Computational Mathematics and Mathema- tik (Mathematics), each with 180 ECTS credits, as part of the application-oriented subject Biology (as well as po- tentially to students of other 'importing' subjects). Should the number of places available in one quota exceed the number of applications, the remaining places will be allocated to applicants from the other quota. Should there be, within one module component, several courses with a restricted number of places, there will be a uni- form regulation for the courses of one module component. In this case, places on all courses of a module com- ponent that are concerned will be allocated in the same procedure. In this procedure, applicants who already ha- ve successfully completed at least one other module component of the respective module will be given preferen-					
A waitin Selection mic ach ve ach in the s at the t average to their will be	tial 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 acade- mic achievements. For this purpose, applicants will be ranked according to the number of ECTS credits they ha- ve 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				

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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) 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)

Master's with 1 major Functional Materials (2022)

Module title					Abbreviation	
Molecular Biology for Advanced Students					08-BC-MOLMC-161-m01	
Module	e coord	inator		Module offered by		
holder	of the (Chair of Biochemistry		Chair of Biochemist	try	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Compri tional b	ising a biocher	lecture and an exercise, t nistry.	his module discusses	s advanced topics in	n molecular physiology and func-	
Intend	ed lear	ning outcomes				
Studen	its have	e developed a sound know	wledge of molecular l	piology.		
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
V (2) +	Ü (1)					
Metho ster, in	d of ass formati	s essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
c) oral d) log (e) pres Langua	examin approx entatio ige of a	ation in groups of up to 3 . 20 pages) or n (approx. 30 minutes) ssessment: German and,	or English	15 minutes per cano	didate) or	
Allocal		Jaces				
 Additio	nal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	e				
		-				
Referre	ed to in	LPO I (examination regu	lations for teaching-d	legree programmes)		
		、 U		<u> </u>		
Module appears in						
Master's degree (1 major) Chemistry (2016)						
Master's degree (1 major) Functional Materials (2016)						
Master	Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)					
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master	Master's degree (1 major) Chemistry (2018)					
Master	's teacl	ning degree Gymnasium l	WINT Teacher Education	on PLUS, Elite Netwo	ork Bavaria (ENB) (2020) P) (2020)	
Master	's door	y course mint reacher E	atorials (2022)	NELWOIK DAVAIIA (ENI	DJ (2020)	
Master	Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Functional Materials (2025)					

Module title					Abbreviation	
Foreign Studies with a focus on Materials Science					08-FU-ALS-222-m01	
Module	e coord	inator		Module offered by		
degree tional I	progra Matrier	mme coordinator Funktio ials)	onswerkstoffe (Func-	Chair of Chemical T	echnology of Material Synthesis	
ECTS	Meth	od of grading	Only after succ. com	pl. of module(s)		
5	(not)	successfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster		Please consult with	course advisory serv	vice in advance.	
Conten	Its					
The int Erasmu at the l	ernship us). The Jnivers	o is carried out at universi content requirements sh ity of Würzburg (what has	ities abroad and can nould comply with the s to be ascertained in	be embedded withir ose of the electives o advance with the st	n offered study programs (eg of the Chemistry Master program sudy coordinator).	
Intend	ed lear	ning outcomes				
The stu have a	ıdents Iso acq	are familiar with working uired language and inter	methods at universit cultural skills.	ies abroad. Besides	professional competences they	
Course	s (type	, number of weekly conta	ct hours, language —	· if other than Germa	n)	
Course Module	e(s) as s e taugh	pecified by respective in t in: German and/or Engl	stitution ish and potentially la	nguage of the respe	ctive country	
Metho ster, in	d of ass formati	sessment (type, scope, la ion on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
a) writt b) oral c) oral d) log (e) pres Langua	en exa examir examin (approx entatio age of a	mination (approx. 90 to 1 nation of one candidate e nation in groups of up to 3 . 20 pages) or n (approx. 30 minutes) assessment: German and	80 minutes) or ach (20 to 30 minute 3 candidates (approx. /or English and poter	s) or . 15 minutes per cano ntially language of th	didate) or e respective country	
Allocat	ion of _l	places				
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teaching cycle						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in						
Master	Master's degree (1 major) Functional Materials (2022)					
Master	Master's degree (1 major) Functional Materials (2025)					

Module title					Abbreviation		
Analyti	cal Me	thods - Examples from Pi	ractical Failure Analy	sis	08-FU-ANA-161-m01		
Module	e coord	inator		Module offered by			
Dean o	f Studie	es Funktionswerkstoffe (F	unctional Materials)	Chair of Chemical T	echnology of Material Synthesis		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
5	nume	rical grade					
Duratio	on d	Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
This mo and po	odule tr lymers)	eats special topics in the . The students become a	e area damage analys quainted to different	is of materials (Cera methods for the cha	mics, semiconductors, metals aracterization of the different ma-		
terial cl	asses.	They deepen this knowle	edge in a practical pa	rt.			
Intende	ed learn	ning outcomes					
The stu	dents §	gain fundamental knowle	dge in measuring me	thods in the physica	al / chemical laborratory.		
Course	s (type	number of weekly conta	ct hours, language —	if other than Germa	n)		
V (2) +	P (2)						
Method ster, in	l of ass formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
a) writt	en exar	nination (approx. 90 to 1	80 minutes) or				
b) oral	examin	ation of one candidate e	ach (20 to 30 minutes	s) or	didata) ar		
d) log (approx	. 20 pages) or	canuluales (applox.	15 minutes per cano	didate) of		
e) pres	entatio	n (approx. 30 minutes)					
Langua	ge of a	ssessment: German and	or English				
Assess P. credi	ment o Itable f	ffered: Once a year, sumi	ner semester				
Allocat	ion of p	laces					
Additio	nal inf	ormation					
Worklo	ad						
150 h							
Teaching cycle							
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in							
Master	Master's degree (1 major) Functional Materials (2016)						
Master	's degre	ee (1 major) Functional M	aterials (2022)				
Master	Master's degree (1 major) Functional Materials (2025)						

Module title Abbreviation					Abbreviation	
Foreign	Studie	25			08-FU-AP-222-m01	
Module	e coord	inator		Module offered by		
degree tional N	progra Aatrieri	mme coordinator Funktio als)	nswerkstoffe (Func-	Chair of Chemical T	echnology of Material Synthesis	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate	Please consult with	course advisory serv	vice in advance.	
Conten	ts					
Practica	al work	related to functional mat	terials in a foreign co	untry.		
Intende	ed learı	ning outcomes				
The stu and the	dents a e cultur	apply their knowledge in e of the country visited.	practical laboratory w	vord and gain basic	understanding of the language	
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
P (o) Module	e taugh	t in: German and/or Engl	ish and potentially la	nguage of the respe	ctive country	
Methoo ster, in	l of ass formati	s essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
a) repo b) talk Langua	rt (10 to (10 to 2 ge of a	o 20 pages) or 20 minutes) ssessment: German and,	or English and poten	itially language of th	e respective country	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Block in	nternsh	ip abroad with at least 2	o working days			
Worklo	ad					
150 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master	's degr	ee (1 major) Functional M	aterials (2022)			
Master	Master's degree (1 major) Functional Materials (2025)					

Module	e title				Abbreviation		
Electrochemical Energy Storage and Conversion					08-FU-EEW-222-m01		
Module	e coord	inator		Module offered by			
holder thesis	of the (Chair of Chemical Techno	logy of Material Syn-	Chair of Chemical T	echnology of Material Synthesis		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
5	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 seme	ster	undergraduate					
Conten	ts						
Chemis nickel r layer ca GaAs, c	stry and netal h apacito organic	l application of battery sy ydride, sodium sulfur, so rs, redox-flow battery, fu and dye solar cell), therr	rstems (aqueous and dium nickel chloride el cell systems (AFC, noelectric devices.	non-aqueous syster , lithium ion accumu PEMFC, DMFC, PAFC,	ns like lead, nickel cadmium and lators), electrochemical double SOFC), Solar cells (Si, CIS, CIGS,		
Intende	ed learn	ning outcomes					
The stu and are	dents g able t	gain comprehensive know o apply this to scientific p	vledge in the field of problems.	electrochemical ene	rgy storage and transformation		
Course	s (type,	, number of weekly conta	ct hours, language —	if other than Germa	n)		
V (2) + Module	S (2) e taugh	t in: German or English					
Methoo ster, in	l of ass formati	e ssment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
a) writt b) talk Langua Assess	en exar (appro) ge of a ment o	nination (approx. 90 min <. 30 minutes); (weighted ssessment: German and, ffered: Once a year, sumi	utes) or oral examina 65:35) /or English ner semester	ation of one candida	te each (approx. 30 minutes) and		
Allocat	ion of p	olaces					
Additio	nal info	ormation					
Worklo	ad						
150 h							
Teachi	Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master	Master's degree (1 major) Functional Materials (2022)						
Master	Master's degree (1 major) Quantum Engineering (2024)						
Master	's degre	ee (1 major) Physics Inter	national (2024)				
Master	Master's degree (1 major) Functional Materials (2025)						

Module title					Abbreviation		
Master Thesis Defense					08-FU-Koll-161-m01		
Module	e coord	inator		Module offered by			
chairpe fe	erson of	f examination committee	Funktionswerkstof-	Chair of Chemical To	echnology of Material Synthesis		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
5	nume	rical grade	o8-FU-MT				
Duratio	n	Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
Prasent	tation a	and defense of the results	s of the Master-Thesis	5			
Intende	ed learı	ning outcomes					
The stu	dents l	earn how to present and	defend a scientif pie	ce of work.			
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)		
К (о)							
Method ster, inf	l of ass formati	e ssment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
final co tes) Langua	lloquiu ge of a	ım (approx. 60 minutes): ssessment: German and,	talk (approx. 30 min /or English	utes) with subseque	nt discussion (approx. 30 minu-		
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
150 h							
Teachir	ng cycl	e					
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master's degree (1 major) Functional Materials (2016)							
Master	's degr	ee (1 major) Functional M	aterials (2022)				
Master	Master's degree (1 major) Functional Materials (2025)						

Module title					Abbreviation		
Materials Science 3					08-FU-MaWi3-222-m01		
Module	e coord	inator		Module offered by			
holder Dentist	of the (try	Chair of Functional Materi	ials in Medicine and	Chair of Chemical T	echnology of Material Synthesis		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
5	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	undergraduate					
Conten	Its						
The mo ticles,	odule co and sol	overs advanced topics in ids.	current areas of mate	erials science, such a	as polymeric materials, nanopar-		
Intend	ed lear	ning outcomes					
Studer zation,	nts acqu proper	uire a comprehensive und ties and application of m	lerstanding of moder aterials.	n materials. This inc	ludes the production, characteri-		
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)		
V (2) +	Ü (2)						
Metho ster, in	d of ass formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
a) writt b) oral c) oral d) log (e) pres Langua	en exal examir examin (approx entatio age of a	mination (approx. 90 to 1 nation of one candidate e ation in groups of up to 3 . 20 pages) or n (approx. 30 minutes) ssessment: German and,	80 minutes) or ach (20 to 30 minute 3 candidates (approx. /or English	s) or 15 minutes per cano	didate) or		
Allocat	ion of p	olaces					
Additio	onal inf	ormation					
Worklo	ad						
150 h							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master	Master's degree (1 major) Functional Materials (2022)						
Master	Master's degree (1 major) Functional Materials (2025)						

Module	e title		Abbreviation				
Master	Thesis	Functional Materials			08-FU-MT-161-m01		
Module	e coord	inator		Module offered by			
degree tional N	progra Natrieri	mme coordinator Funktic als)	onswerkstoffe (Func-	Chair of Chemical T	echnology of Material Synthesis		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
25	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
Studen hering	ts will I to the p	be expected to research a principles of good scienti	and write on a defined fic practice.	d topic in the techno	logy of functional materials, ad-		
Intende	ed learı	ning outcomes					
Studen and to	ts are a presen	able to conduct research t the results of their work	on a defined topic, ad in written form.	dhering to the princi	ples of good scientific practice,		
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)		
No cou	rses as	signed to module					
Method ster, in	d of ass formati	e ssment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
Master Langua	's thesi Ige of a	s (approx. 70 pages) ssessment: German and,	/or English				
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Time to	compl	ete: 6 months.					
Worklo	ad						
750 h							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master	Master's degree (1 major) Functional Materials (2016)						
Master	's degr	ee (1 major) Functional M	aterials (2022)				
Master	Master's degree (1 major) Functional Materials (2025)						

Module title					Abbreviation		
Structure-Properties Correlations of Light Materials - Experiments and Numeri-					08-FU-MW-222-m01		
cal Simu							
Module	coordi	nator		Module offered by			
degree p tional Ma	orograi atrieri	mme coordinator Funktio als)	nswerkstoffe (Func-	Chair of Chemical T	echnology of Material Synthesis		
ECTS I	Metho	d of grading	Only after succ. com	pl. of module(s)			
5 r	numer	ical grade					
Duration	1	Module level	Other prerequisites				
1 semest	ter	graduate					
Contents	s						
Material	prope	erties of metals and cerar	nics: Structur-proper	ty relationships thro	ugh experiments and simulation.		
Intended	d learn	ing outcomes					
The stud and high sented. T sized.	lents g n perfo The re	ain fundamental knowle rmance ceramics. Analyt lationship of mikro- and	dge about the proper ical methods and pre nanoscopic structure	rties of modern mate edictions through nu of materials and the	erials: aviation aluminum alloys merical simulations will be pre- e resulting properties are empha-		
Courses	(type,	number of weekly conta	ct hours, language —	if other than Germa	n)		
V (2) + S	(2)						
Module t	taught	in: German or English					
Method of ster, info	of ass ormation	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
a) writter b) talk (a Languag Assessm	n exar approx ge of as nent of	nination (approx. 90 min a. 30 minutes); (weighted ssessment: German and/ ffered: Once a year, sumr	utes) or oral examina 60:40) ′or English ner semester	tion of one candida	te each (approx. 30 minutes) and		
Allocatio	on of p	laces					
Addition	al info	ormation					
Workloa	d						
150 h							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master's	Master's degree (1 major) Functional Materials (2022)						
Master's	Master's degree (1 major) Quantum Engineering (2024)						
Master's	s degre	ee (1 major) Physics Inter	national (2024)				
Master's	s degre	ee (1 major) Functional M	aterials (2025)				

Module	e title		Module title			
Chemical Nanotechnology: Analytics and Applications			nd Applications		08-FU-NT-AA-152-m01	
Module	e coord	inator		Module offered by		
degree tional <i>I</i>	progra Natrieri	mme coordinator Funktio als)	onswerkstoffe (Func-	Chair of Chemical T	echnology of Material Synthesis	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade		-		
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Introdu rheoloยู	iction to gical m	o the theory and applicat ethods, dynamic light sca	ion of characterisatio attering. Application o	n methods in nanoto of nanomaterials in i	echnology. Thermoanalysis, ndustry and technology.	
Intende	ed lear	ning outcomes				
Studen	its have	e developed an advanced	knowledge of the ch	aracterisation and a	pplication of nanomaterials.	
Course	s (type	, number of weekly conta	ct hours, language –	if other than Germa	n)	
V (4)						
Metho	d of ass	essment (type, scope, la	nguage — if other tha	an German, examina	tion offered — if not every seme-	
ster, in	formati	on on whether module ca	an be chosen to earn	a bonus)		
a) writt	en exai	nination (approx. 90 to 1	80 minutes) or			
c) oral	examir examin	ation of one candidate e	ach (20 to 30 minute 2 candidates (approx	s) or 15 minutes per cano	didate) or	
d) log (approx	. 20 pages) or				
e) pres	entatio	n (approx. 30 minutes)				
Langua	ige of a	ssessment: German and,	/or English			
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination regu	lations for teaching-o	legree programmes)		
Module appears in						
Bachel	or's de	gree (1 major) Nanostruct	ure Technology (201	5)		
Master	's degr	ee (1 major) Functional M	aterials (2016)	 X 		
Bachel	or's de	gree (1 major) Nanostruct	ure Technology (202	0)		
Bachel	ors de	gree (1 major) Quantum	ecnnology (2021)			
Master	s uegri 's door	ee (1 major) runctional M	aterials (2022)			
master	Jucgi		2025)			

Module title					Abbreviation	
Resear	ch Proj	ect 1			08-FU-PR1-161-m01	
Module	e coord	inator		Module offered by		
degree tional N	progra Aatrieri	mme coordinator Funktio als)	nswerkstoffe (Func-	Chair of Chemical To	echnology of Material Synthesis	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
This mo rials.	odule g	ives students the opport	unity to work indeper	ndently on experimer	nts on a topic in functional mate-	
Intende	ed lear	ning outcomes				
Studen in writte	ts are a en form	able to independently wo 1.	rk on a defined topic	in functional materia	als and to present their findings	
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
R (10)						
Methoo ster, int	l of ass formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
report (Langua	approx ge of a	x. 25 pages) ssessment: German and,	or English			
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
300 h						
Teachir	ıg cycl	e				
Referre	d to in	LPOI (examination regu	lations for teaching-c	legree programmes)		
Module	e appea	ars in				
Master	's degr	ee (1 major) Functional M	aterials (2016)			
Master	's degr	ee (1 major) Functional M	aterials (2022)			
Master	's degr	ee (1 major) Functional M	aterials (2025)			

Module title					Abbreviation
Resear	ch Proj	ect 2			08-FU-PR2-161-m01
Module	e coord	inator		Module offered by	
degree tional N	progra Aatrieri	mme coordinator Funktio als)	nswerkstoffe (Func-	Chair of Chemical To	echnology of Material Synthesis
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
This mo rials.	odule g	ives students the opport	unity to work indeper	ndently on experimer	nts on a topic in functional mate-
Intende	ed lear	ning outcomes			
Studen in writte	ts are a en form	able to independently wo 1.	rk on a defined topic	in functional materia	als and to present their findings
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
R (10)					
Methoo ster, int	l of ass formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
report (Langua	approx ge of a	x. 25 pages) ssessment: German and,	or English		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teachir	ıg cycl	e			
Referre	d to in	LPOI (examination regu	lations for teaching-o	legree programmes)	
Module	e appea	urs in			
Master	's degr	ee (1 major) Functional M	aterials (2016)		
Master	's degr	ee (1 major) Functional M	aterials (2022)		
Master	's degr	ee (1 major) Functional M	aterials (2025)		

Module	e title				Abbreviation	
Polymer Materials 1: Technology of Polymer Modification					08-FU-PW1-161-m01	
Module	e coord	inator		Module offered by		
degree tional N	progra Aatrieri	mme coordinator Funktic als)	nswerkstoffe (Func-	Chair of Chemical T	echnology of Material Synthesis	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Polyme logies f lymer c	r synth or the i ompou	esis methods; the struct nanufacturing of polyme nds and components.	ure of polymers and p r compounds and co	polymer compounds; mponents, procedur	; properties of polymers; techno- es for the characterisation of po-	
Intende	ed learı	ning outcomes				
Studen and ten portant such as nufactu cessing	ts have nperatu produ inject ired pro g machi	e developed a knowledge ure-dependent viscoelast ction technologies (polyr ion moulding) and under oducts. They have becom ines and tools.	of the special prope ic behaviour). They h ner synthesis methoo stand the different w e familiar with ways	rties of polymers and ave become familian ds, compounding tec ays of influencing th to calculate complex	d polymer compounds (e.g. time r with the characteristics of im- chnologies, processing methods e properties of materials and ma- c flow conditions in polymer pro-	
Course	s (type	, number of weekly conta	ct hours, language —	· if other than Germa	n)	
V (2) +	P (2)					
Methoo ster, inf	l of ass formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
a) writte b) oral e c) oral e Langua Assess P: credi	en exar examin examin ge of a ment o itable f	nination (approx. 90 min ation of one candidate e ation in groups (groups o ssessment: German and, ffered: Once a year, winto or bonus	utes) or ach (approx. 20 minu of 2, approx. 30 minu /or English er semester	ites) or tes per candidate)		
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
150 h						
Teachir	Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	e appea	rs in				
Master	's degr	ee (1 major) Functional M	aterials (2016)			
Master	's degr	ee (1 major) Functional M	aterials (2022)			
Master	s degre	ee (1 major) Biofabricatio	N (2025) aterials (2025)			
master	s uegn	ee (I major) runctional M	alenais (2025)			

Module title	Abbreviation					
Polymer Materials 2: Technology of	08-FU-PW2-161-m01					
Module coordinator		Module offered by				
degree programme coordinator Funktionswerkstoffe (Func- tional Matrierials)						
ECTS Method of grading	Only after succ. con	npl. of module(s)				
5 numerical grade						
Duration Module level	Other prerequisites					
1 semester graduate						
Contents						
Principles of and technologies for the ons between filler materials and poly (e.g. electrical behaviour, bactericida rheology, mechanical behaviour, colo	e functionalisation of fi mers, determination o Il behaviour) and influe our, surface).	ller materials in orde f the special properti ence of functionalisa	er to modify polymers, interacti- ies of functionalised polymers tion on other properties (e.g.			
Intended learning outcomes						
Students have become familiar with ped an awareness of the possibilities interactions between filler materials tionalised polymers (e.g. electrical be influenced by functionalisation (e.g.	technologies for the fu s and problems associa and polymers. They kn ehaviour, bactericidal l rheology, mechanical l	nctionalisation of fill ated with the modific ow how to determine behaviour) and unde behaviour, colour, su	er materials. They have develo- cation of polymers as well as the the special properties of func- rstand how other properties are urface).			
Courses (type, number of weekly con	tact hours, language –	- if other than Germa	n)			
V (2) + P (2)						
Method of assessment (type, scope, ster, information on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-			
a) written examination (approx. 90 m b) oral examination of one candidate c) oral examination in groups (groups Language of assessment: German an Assessment offered: Once a year, su P: creditable for bonus	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) Language of assessment: German and/or English Assessment offered: Once a year, summer semester					
Allocation of places						
Additional information						
Workload						
150 h						
Teaching cycle						
Referred to in LPO I (examination res	Referred to in LPO I (examination regulations for teaching-degree programmes)					
	0					
Module appears in						
Master's degree (1 major) Functional	Materials (2016)					
Master's degree (1 major) Functional	Materials (2022)					
Master's degree (1 major) Functional	Materials (2025)					

Module title					Abbreviation		
Sol-Gel	Chemi	istry			08-FU-SGC-222-m01		
Module	e coord	inator		Module offered by			
holder thesis	of the (Chair of Chemical Techno	logy of Material Syn-	Chair of Chemical T	echnology of Material Synthesis		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)			
3	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 seme	ster	undergraduate					
Conten	ts						
This mo of analy	odule p ysis us	rovides an introduction t ed to characterise the get	o the synthesis meth nerated materials.	ods of sol-gel chemi	stry and discusses the methods		
Intende	ed learr	ning outcomes					
Studen	ts have	e developed an advanced	knowledge of sol-ge	l chemistry.			
Course	s (type,	, number of weekly conta	ct hours, language —	if other than Germa	n)		
V (3) Module	e taugh	t in: German or English					
Methoo ster, int	l of ass formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-		
a) writte b) oral e c) oral e d) log (a e) prese Langua	 a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) l approace of according and (or Englich) 						
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
90 h							
Teaching cycle							
Referre	d to in	LPOI (examination regu	lations for teaching-c	legree programmes)			
Module	appea	irs in					
Master	's degre	ee (1 major) Functional M	aterials (2022)				
			(=)				

Module title				Abbreviation		
Special Topics of Materials Science					08-FU-ST-222-m01	
Module coordinator				Module offered by		
holder thesis	ofthe	Chair of Chemical Techno	logy of Material Syn-	Chair of Chemical T	echnology of Material Synthesis	
ECTS	Meth	od of grading	Only after succ. com	pl. of module(s)		
5	(not)	successfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster					
Conten	its					
The mo	dule c	overs current and/or spec	cial topics in Material	s Chemistry.		
Intend	ed lear	ning outcomes				
The stu quired zation	ident h knowle methoo	as advanced knowledge edge in the subject-specif ds und the application are	of selected topics in l ic contexts, knows th eas.	Materials Chemistry. le synthetic methods	He/she is able to classify the ac- s, the properties, the characteri-	
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
V (3)						
Metho ster, in	d of ass format	sessment (type, scope, la ion on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
a) writt b) oral c) oral d) log (e) pres Langua	en exa examir examin (approx entatio age of a	mination (approx. 90 to 1 nation of one candidate e nation in groups of up to 3 a. 20 pages) or on (approx. 30 minutes) assessment: German and,	80 minutes) or ach (20 to 30 minute 3 candidates (approx. /or English	s) or 15 minutes per cano	didate) or	
Allocat	ion of _l	places				
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teaching cycle						
Referre	ed to in	LPO I (examination regu	lations for teaching-o	legree programmes)		
Module	e appea	ars in				
Master	's degr	ee (1 major) Functional M	aterials (2022)			
Master	Master's degree (1 major) Functional Materials (2025)					

Module title			Abbreviation			
Organic F	Organic Functional Materials 08-OCM-FM-161-m01					
Module c	oordinator		Module offered by			
lecturer of the seminar "Organische Funktionsmaterialien" Institute of Organic Chemistry						
ECTS M	lethod of grading	Only after succ. com	npl. of module(s)			
5 n	umerical grade		1			
Duration	Module level	Other prerequisites				
1 semeste	er graduate					
Contents						
The modu sical effect componen linear opt	le deals with specific topics i cts in organic molecular and p nts such as field effect transis ics.	n organic functional olymeric semicondu stors, organic light-er	materials. The focus ctors as well as their nitting diodes, or org	is on fundamental (photo)phy- application in (opto)electronic ganic solar cells as well as in non-		
Intended	learning outcomes					
The stude explain th ents such near optic	ents are able to explain fundation synthesis of these semicon as field effect transistors, org	mental (photo)physic ductor materials as v ganic light-emitting d	cal processes in orga vell as their applicat iodes or in organic p	nic semiconductors. He/She can ion in (opto)electronic compon- hotovoltaics as well as in nonli-		
Courses (type, number of weekly conta	ct hours, language —	- if other than Germa	n)		
S (3)						
Method o ster, infor a) written b) oral exa c) oral exa d) log (ap e) present Language Allocation Additiona 150 h Teaching Referred t	S (3) 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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English Allocation of places Additional information Workload 150 h Teaching cycle 					
Module appears in						
Master's of Master's of Suppleme Master's of Master's of Suppleme Master's of	Module appears in Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Functional Materials (2022)					

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

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

Module title					Abbreviation		
Moder	n Synth	etic Methods			08-0CM-SYNT-161-	m01	
Modul	e coord	inator		Module offered by			
locturo	r of the	cominar		Institute of Organic	Chomistry		
	Mothe	od of grading	Only after succ. con	nl of modulo(s)	Chemistry		
5	nume	rical grade					
Duratia	nume	Module level	Other prorequisites				
1 seme	ster	graduate					
Conter	nts	0					
This m nometa	odule d allic che	iscusses modern sterec emistry and catalysis.	oselective synthesis m	ethods. It focuses o	n selected total synt	heses, orga-	
Intend	ed lear	ning outcomes					
Studer They ca sis che	nts are a an expla emistry.	able to stereoselectively ain total syntheses. The	plan complex chemic y can describe aspect	al syntheses and to s of organometallic c	stereochemically an hemistry and cataly	alyse them. sis in synthe-	
Course	s (type	, number of weekly cont	act hours, language –	- if other than Germa	ın)		
S (2) + Module	Ü (1) e taugh	t in: German or English					
Metho ster, in	d of ass formati	sessment (type, scope, l on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	ition offered — if not	every seme-	
c) oral d) log (e) pres Langua Allocat	examin (approx entatio age of a t ion of p	ation in groups of up to . 20 pages) or n (approx. 30 minutes) ssessment: German and blaces	3 candidates (approx d/or English	. 15 minutes per can	didate) or		
 Additic	nal inf	ormation					
			_				
Workle	ad						
workit	au						
150 m							
Teachi	ng cyci	e					
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)			
Modul	e appea	urs in					
Master's degree (1 major) Chemistry (2016)							
Master's degree (1 major) Functional Materials (2016)							
Master's teaching degree Gymnasium MINT leacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Master's teaching degree Sympasium MINT Teacher Education DLUS Elite Network Pavaria (ENP) (2020)							
Supple	Supplementary course MINT Teacher Education PLUS, Flite Network Bayaria (FNB) (2020)						
Master's degree (1 major) Functional Materials (2022)							
Master	Master's degree (1 major) Chemistry (2024)						
Master	's teacl	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netw	ork Bavaria (ENB) (2	025)	
Master's w	ith 1 majo	r Functional Materials (2022)	JMU Würzburg • ta record Maste	generated 19-Apr-2025 • exa r (120 ECTS) Funktionswerkst	am. reg. da- toffe - 2022	page 36 / 104	


Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Functional Materials (2025)

Module title					Abbreviation	
Laser S	pectro	scopy			08-PCM1a-161-m01	
Module	e coord	inator		Module offered by		
lecture copy)	r of ser	ninar "Laserspektrosko	pie" (Laser Spectros-	Institute of Physical and Theoretical Chemistry		
ECTS	Methe	od of grading	Only after succ. con	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts	•				
This mo and em	odule i iission	ntroduces students to t spectroscopy.	ne fundamental princi	oles of laser spectros	scopy. It discusses a	bsorption
Intende	ed lear	ning outcomes				
Studen of laser	ts are a r techn	able to explain the com ology. They are able to o	oonents and operating	principles of lasers of absorption and e	as well as the optica mission spectrosco	al principles oy.
Course	s (type	, number of weekly con	tact hours, language –	- if other than Germa	n)	
S (2) +	Ü (1)	· · · · · · · · · · · · · · · · · · ·				
Module	e taugh	t in: German or English				
Methoo ster, in	d of ass formati	sessment (type, scope, ion on whether module	language — if other tha can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
a) writt b) oral Langua	en exa examir ge of a	mination (approx. 90 m nation of one candidate ssessment: German an	inutes) or each (approx. 20 minu d/or English	utes)		
Allocat	ion of _l	olaces				
Additio	nal inf	ormation				
Worklo	ad					
150 h						
Teachir	ng cvcl	e				
Referre	d to in	LPOI (examination reg	ulations for teaching-	legree programmes)		
				203.00 p.03.00)		
Module	2000	arc in				
Module	appea	115 III a a (1 ma a i a m) Ch a mai a tm i ((
Master	's aegr	ee (1 major) Chemistry (oo (1 major) Mathemati	(2016)			
Master	s uegi 's dogr	ee (1 major) Mathematic	unal Mathematics (201	6)		
Master	s uegi 's door	ee (1 major) Computation	Materials (2016)	0)		
Master's teaching degree Sympasium MINT Teacher Education DLUS, Elite Network Payaria (ENP) (2016)						
Master's reaching degree dyninasium Mint Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education DLUS, Elite Network Bavaria (ENB) (2016)						
Master's degree (1 major) Chemistry (2018)						
Master's degree (1 major) Computational Mathematics (2010)						
Master's degree (1 major) Computational Mathematics (2019)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS. Elite Network Bavaria (ENB) (2020)						
Supple	Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)					
Master	Master's degree (1 major) Computational Mathematics (2022)					
Master	's degr	ee (1 major) Functional	Materials (2022)			
Master's wi	ith 1 majo	r Functional Materials (2022)	JMU Würzburg •	generated 19-Apr-2025 • exa	m. reg. da-	page 38 / 104
			ta record Maste	r (120 ECTS) Funktionswerkst	offe - 2022	

Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Chemistry (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (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) Master's degree (1 major) Functional Materials (2025)

Module title				Abbreviation		
Statist	Statistical Mechanics and Reaction Dynamics 08-PCM2-161-m01					
Module	e coord	inator		Module offered by	<u> </u>	
lecture	r of ser	ninar "Chemische Dyna	mik" (Chemical Dyna-	Institute of Physica	l and Theoretical Ch	emistry
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	Duration Module level Other prerequisites					
1 seme	1 semester graduate					
Conten	its					
This mo clude t reactio	This module discusses selected topics in statistical mechanics and reaction dynamics. Topics to be covered in- clude the fundamental principles of statistical thermodynamics, the transition state theory, uni- and bimolecular reactions as well as charge and energy transfer.					
Intende	ed lear	ning outcomes				
Studen learneo	its have d and a	e become familiar with re able to apply the fun	selected topics in stati damental principles of	stical mechanics and statistical thermody	d reaction dynamics. /namics.	. They have
Course	s (type	, number of weekly con	tact hours, language –	- if other than Germa	in)	
S (2) + Module	Ü (1) e taugh	t in: German or English				
Metho ster, in	d of as formati	sessment (type, scope, ion on whether module	language — if other the can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 20 minutes) or c) talk (approx. 30 minutes) Language of assessment: German and/or English Allocation of places						
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination reg	gulations for teaching-	degree programmes)		
		· · ·				
Module	e appea	ars in				
Master	's degr	ee (1 maior) Chemistry	(2016)			
Master	's degr	ee (1 major) Mathemati	cs (2016)			
Master	Master's degree (1 major) Computational Mathematics (2016)					
Master's degree (1 major) Functional Materials (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018)						
Master's degree (1 major) Computational Mathematics (2019)						
Master Master Supple	's degr 's teacl menta	ee (1 major) Mathemati hing degree Gymnasiun ry course MINT Teacher	cs (2019) n MINT Teacher Educat Education PLUS, Elite	ion PLUS, Elite Netwo Network Bavaria (EN	ork Bavaria (ENB) (2 B) (2020)	020)
Master's w	ith 1 majo	r Functional Materials (2022)	JMU Würzburg • ta record Maste	generated 19-Apr-2025 • exa r (120 ECTS) Funktionswerkst	am. reg. da- coffe - 2022	page 40 / 104

Module title Abbreviation						
Nanos	Nanoscale Materials 08-PCM3-161-m01					
Modul	e coord	inator		Module offered by	<u> </u>	
lecture	er of the	seminar "Nanoskalige	Materialien"	Institute of Physical and Theoretical Chemistry		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		ennotry
5	nume	rical grade				
Durati	on	Module level	Other prerequisites			
1 seme	ester	graduate				
Conte	nts					
This m on, mo	odule d odern ch	iscusses advanced top naracterisation methods	ics in nanoscale mater and application area	ials. It focuses on th s of nanoscale mater	e structure, properti rials.	es, fabricati-
Intend	Intended learning outcomes					
Stude on are	nts are a as of na	able to characterise nan noscale materials.	oscale materials. They	<i>r</i> are able to name ar	nalytical methods an	nd applicati-
Course	es (type	, number of weekly cont	act hours, language –	- if other than Germa	ın)	
S (2) +	Ü (1)	· · · · · ·			•	
Modul	e taugh	t in: German or English				
Metho ster, ir	d of ass nformati	sessment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
a) writ	ten exai	mination (approx. 90 m	inutes) or			
b) oral	examir	ation of one candidate	each (approx. 20 mini	utes) or		
c) talk	(appro)	(. 30 minutes) coossmont: Cormon on	d /or English			
credita	age of a able for	bonus	u/or Eligiish			
Alloca	tion of p	olaces	_			
Additi	onal inf	ormation				
Workl	oad					
150 h						
Teach	ing cycl	e				
Referr	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
				<u> </u>		
Modul	e appea	urs in				
Maste	r's degr	ee (1 major) Chemistry (2016)			
Maste	r's degr	ee (1 major) Mathematic	cs (2016)			
Maste	r's degr	ee (1 major) Computatio	onal Mathematics (201	6)		
Maste	r's degr	ee (1 major) Functional	Materials (2016)			
Maste	r's teacl	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (2)	016)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master's degree (1 major) Chemisly (2018) Master's degree (1 major) Computational Mathematics (2010)						
Maste	Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2010)					
Maste	Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)					
Supple	Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)					
Bache	lor's de	gree (1 major) Quantum	Technology (2021)			
Master's v	vith 1 majo	r Functional Materials (2022)	JMU Würzburg • ta record Maste	generated 19-Apr-2025 • exa r (120 ECTS) Funktionswerkst	am. reg. da- toffe - 2022	page 42 / 104

Module title				Abbreviation		
Ultrafast spectroscopy and quantum-control 08-PCM4-161-m01						
Modul	e coord	inator		Module offered by		
locture	r of the	cominar "Nanockaliga	Matorialion"	Institute of Dhysical and Theoretical Chemistry		
	Mothe	seminar Nanoskalige		nistitute of Physica		emistry
	nume	rical grade	Only after succ. con	ipt. of module(s)		
5 Durati	munie					
Duratio	on	module level	Drior completion of	modulos os DCM12	and as DCM1b racan	amondod
Conter	its	graduate				imenueu.
This m	This module discusses advanced topics in ultrafast spectroscopy and quantum control. It focuses on ultrashort					
Intend	ed lear	ning outcomes				
Studer	ts are a	able to describe the gen	eration of ultrashort la	ser nulses and to ch	aracterise them The	ev can ex-
plain tl princip	he theo les and	ry of time-resolved lase l applications of quantu	r spectroscopy and na m control.	me experimental me	thods. They can des	cribe the
Course	s (type	, number of weekly cont	act hours, language –	- if other than Germa	n)	
S (2) + Module	Ü(1) e taugh	t in: German or English				
Metho		assment (type scope)	if other th	an Corman, oyamina	tion offered — if not	avani sama-
ster, in	formati	on on whether module	can be chosen to earn	a bonus)		every serile-
a) writt	en exai	mination (approx. 90 mi	nutes) or			
b) oral	examin	ation of one candidate	each (approx. 20 mini	utes) or		
c) talk	(approx	(. 30 minutes) ssossmont: Gorman and	d/or English			
Allegat						
Allocal		Jaces				
			_			
Additio	onal info	ormation				
			_			
Worklo	ad					
150 h						
Teachi	ng cycl	e				
			_			
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
Modul	e appea	irs in				
Master	's degr	ee (1 major) Chemistry (2016)			
Master	's degr	ee (1 major) Mathematic	:s (2016)			
Master's degree (1 major) Physics (2016)						
Master's degree (1 major) Nanostructure Technology (2016)						
Master's degree (1 major) Computational Mathematics (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master's degree (1 major) Chemistry (2018)						
Master	s uegn כ s deori	ee (1 major) Computatio	rat mathematics (201 rs (2010)	<i>yı</i>		
Master	's degr	ee (1 major) Nanostruct	Jre Technology (2020)			
Master	's degr	ee (1 major) Physics (20	20)			
Mactoria	ith a main	Functional Materials (acco)	18411 \ \ A/::	generated to Apr ages	am rog da	
master S W	nii i iiajoi	runctional Materials (2022)	ta record Maste	r (120 ECTS) Funktionswerkst	offe - 2022	paze 44 / 104



Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Physics International (2020) Master's degree (1 major) Quantum Engineering (2020) Master's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Quantum Engineering (2024) Master's degree (1 major) Physics International (2024) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Computational Mathematics (2024)

Module title			Abbreviation		
Physical Chemistry of Supramolecular Assemblies				08-PCM5-161-m01	
Module coordinator			Module offered by	<u> </u>	
lecturer of the kularer Strukt	seminar "Physikalische uren"	e Chemie Supramole-	Institute of Physical and Theoretical Chemistry		
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)		
5 nume	5 numerical grade				
Duration	Module level	Other prerequisites	i		
1 semester	1 semester graduate				
Contents					
This module examines the basic interactions between molecules. It discusses the formation and physical-chemi- cal properties of aggregates as well as key applications of supramolecular chemistry.					
Intended lear	ning outcomes				
Students are in the field. Th dern application	able to explain the basi ney can describe the for ions of supramolecular	c interactions between mation and physical-c chemistry.	n molecules demonst hemical properties o	rating a high degree f aggregates. They c	of expertise an name mo-
Courses (type	, number of weekly con	tact hours, language –	- if other than Germa	n)	
S (2) + Ü (1) Module taugh	it in: German or English				
Method of as	sessment (type, scope,	language — if other the	an German, examina	tion offered — if not	every seme-
ster, informat	ion on whether module	can be chosen to earn	a bonus)		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 20 minutes) or c) talk (approx. 30 minutes) Language of assessment: German and/or English					
Allocation of	places				
	<u>'</u>				
Additional inf	ormation				
Workload					
worktoau					
150 11					
Teaching cycl	e				
Referred to in	LPOI (examination reg	gulations for teaching-o	degree programmes)		
Module appea	ars in				
Master's degr	ee (1 major) Chemistry ((2016)			
Master's degree (1 major) Mathematics (2016)					
Master's degree (1 major) Computational Mathematics (2016)					
Master's degree (1 major) Functional Materials (2016)					
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)					
Master's degree (1 major) Chemistry (2018)					
Master's degree (1 major) Computational Mathematics (2019)					
Master's degr	ee (1 major) Mathemati	cs (2019)			``
Master's teac Supplementa	ning degree Gymnasiun ry course MINT Teacher	n MINT Teacher Educat Education PLUS, Elite	ion PLUS, Elite Netwo Network Bavaria (EN	огк Bavaria (ENB) (2 В) (2020)	020)
Master's with 1 majo	r Functional Materials (2022)	JMU Würzburg • ta record Maste	e generated 19-Apr-2025 • exa er (120 ECTS) Funktionswerkst	am. reg. da- coffe - 2022	page 46 / 104

Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Chemistry (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (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)

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

Module title				Abbreviation	
Supran	Supramolecular Chemistry (Basics) 08-SCM1-161-m01				08-SCM1-161-m01
Module	e coordi	inator		Module offered by	
lecture sics)"	r of the	seminar "Supramolecula	ar Chemistry (Ba-	Institute of Organic	Chemistry
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
5	numei	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
This mo actions nation dern ap	This module introduces students to the fundamental principles of supramolecular chemistry. It focuses on inter- actions between molecules, molecular recognition by receptors, complexes, supramolecular polymers, coordi- nation polymers and networks, liquid crystals, self-assembly in aqueous media, synthetic ion channels and mo- dern applications of supramolecular chemistry.				
Intende	ed learr	ning outcomes			
Studen field as describ ion cha	Students are able to explain interactions between molecules demonstrating a high degree of expertise in the field as well as to describe the formation, structure and polymers of coordination compounds. They are able to describe the self-assembly of polymers in aqueous media as well as to identify the characteristics of synthetic ion channels. They can name modern applications of supramolecular chemistry.				
Course	s (type,	number of weekly conta	ct hours, language –	- if other than Germa	n)
S (3) Module	S (3) Module taught in: German or English				
Methoo ster, inf	l of ass formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
a) writte b) oral Langua	en exar examin ge of a	nination (approx. 90 min ation of one candidate e ssessment: German and,	utes) or ach (approx. 20 minu /or English	utes)	
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Worklo	ad				
150 h			,		
Teachir	ng cycle	2			
Referre	d to in	LPO I (examination regu	lations for teaching-o	degree programmes)	
Module	appea	rs in			
Master	's degre	ee (1 major) Functional M	aterials (2016)		
Master	's degre	ee (1 major) Functional M	aterials (2022)		
Master	's degre	ee (1 major) Chemistry (2	024)		
Master	's teach	ning degree Gymnasium I	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (2025)
Supple	mentar	y course MINT Teacher Ed	ducation PLUS, Elite I	Network Bavaria (EN	B) (2025)
Master	s aegre 's dear	e (1 major) Biofabricatio e (1 major) Functional M	n (2025) aterials (2025)		
master's degree (1 major) functional materials (2025)					

Module title				Abbreviation		
Bioorga	anic Ch	emistry			08-SCM3-152-m01	
Module	e coord	inator		Module offered by		
lecture Chemis	r of lect stry)	ture "Bioorganische Ch	emie" (Bioorganic	Institute of Organic Chemistry		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Contents						
Bioorganic chemistry unites the central questions of organic chemistry, biochemistry, medicinal chemistry and spectroscopy with a focus on biomolecules. At the core of bioorganic chemistry is the synthesis and purposeful manipulation of biomolecules, such as nucleic acids, peptides, proteins, carbohydrates and lipids. This includes the framework of structure-function relationships and the fundamental understanding of biological mechanisms, to enable applications towards biomaterials, biosensing, bioimaging, clinical diagnostics and therapeutics. Key concepts covered in the course are nucleic acid chemistry, peptide chemistry, carbohydrate chemistry, bioorthogonal reactions, molecular diversity, solid-phase synthesis, molecular recognition and interactions (ligand-receptor interactions, signal transduction)						
Intende	ed learı	ning outcomes				
The students will have a molecular understanding of the structure and reactivity of biomolecules. The students obtain knowledge of modern synthetic methods in bioorganic chemistry and can explain principles of molecular interactions and recognition mechanisms. They can describe modern aspects of nucleic acids, proteins, carbohydrates and lipids.						
Course	s (type	, number of weekly con	tact hours, language –	- if other than Germa	n)	
S (3)						
Methoo ster, inf	l of ass formati	sessment (type, scope, on on whether module	language — if other the can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
a) writte b) oral c) oral e Langua	en exar examin examin ge of a	mination (approx. 45 to nation of one candidate ation in groups of up to ssessment: German an	90 minutes) or each (20 to 30 minute 93 candidates (15 to 30 d/or English	es) or o minutes per candid	late)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
WOIKIO	au					
150 n						
Teachir	ig cycl	e				
Referre	d to in	LPOI (examination reg		degree programmes)		
Module appears in						
Master' Master' Master' Master' Supple	Module appears in Master's degree (1 major) Biochemistry (2015) Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's with 1 major Functional Materials (2022) JMU Würzburg • generated 19-Apr-2025 • exam. reg. da- page 49 / 104					
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Master's degree (1 major) Biochemistry (2017) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Biochemistry (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Functional Materials (2022) 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 title				Abbreviation		
Selected Topics in Theoretical Chemistry 08-TCM1-161-m01						
Modul	0 00000	inator		Modulo offered by		
Modul			• •	In stitute of Division long of The section Chamister		
lecture	er of lect	ture "Theoretische Cher		Institute of Physica	l and Theoretical Ch	emistry
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites	6		
1 seme	ester	graduate				
Conter	its					
This m	This module introduces students to the fundamental principles of theoretical chemistry.					
Intend	ed learı	ning outcomes				
Studer	nts are a	able to describe the mat	hematical and physic	al principles underly	ing the quantum che	emical and
quantu	ım dyna	amical approaches of th	eoretical chemistry.			
Course	s (type	, number of weekly cont	act hours, language –	– if other than Germa	n)	
S (2) +	Ü (2)					
Metho	d of ass	essment (type, scope	anguage — if other th	an German, examina	tion offered — if not	everv seme-
ster, in	formati	on on whether module	can be chosen to earn	a bonus)		. story serie
a) writt	en exa	mination (approx, 90 to	180 minutes) or			
b) oral	examin	ation of one candidate	each (20 to 30 minute	es) or		
c) oral	examin	ation in groups of up to	3 candidates (approx	. 15 minutes per cano	didate) or	
d) log	(approx	. 20 pages) or				
e) pres	entatio	n (approx. 30 minutes)				
Langua	age of a	ssessment: German and	d/or English			
Allocat	tion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
Modul	e annea	urs in				
Master	's dogr	no III no (1 major) Chemistry (2016)			
Master	's degr	ee (1 major) Chemistry (2010) SS (2016)			
Master	's degr	ee (1 major) Mathematic	nal Mathematics (201	6)		
Master	's degr	ee (1 major) Functional	Materials (2016)			
Master	's teach	ning degree Gymnasium	MINT Teacher Educat	ion PLUS. Elite Netwo	ork Bavaria (ENB) (2	016)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (FNB) (2016)						
Master's degree (1 major) Chemistry (2018)						
Master	's degr	ee (1 major) Computatio	nal Mathematics (201	.9)		
Master	's degr	ee (1 major) Mathematio	.s (2019)			
Master	's teacl	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (2	020)
Supple	ementar	y course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2020)	
Master	's degr	ee (1 major) Computatio	onal Mathematics (202	22)		
Master	's degr	ee (1 major) Functional	Materials (2022)			
Master's w	ith 1 majoi	Functional Materials (2022)	JMU Würzburg	• generated 19-Apr-2025 • exa	am. reg. da-	page 51 / 104
			ta record Maste	er (120 ECTS) Funktionswerkst	offe - 2022	

Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Chemistry (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (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) Master's degree (1 major) Functional Materials (2025)

Module title				Abbreviation		
Basics and Applications of Quantum Chemistry 08-TCM2-161-m01						
Modul	0 00000	inator		Modulo offered by		
Modul			• • •	In stitute of Division and The section Chamister		
lecture	r of lect	ture "Computational Ch	emistry"			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	graduate				
Conter	its					
This m	This module introduces students to the fundamental principles of computational chemistry.					
Intend	ed learı	ning outcomes				
Studer	nts are a	able to explain the theor	retical principles of co	mputational chemist	ry and to apply met	hods in com-
putatio	onal che	emistry.				
Course	s (type	, number of weekly cont	act hours, language –	- if other than Germa	n)	
S (2) +	Ü (2)					
Metho	d of ass	sessment (type, scope,	language — if other th	an German, examina	tion offered — if not	every seme-
ster, in	formati	on on whether module	can be chosen to earn	a bonus)		
a) writt	en exa	mination (approx. 90 to	180 minutes) or			
b) oral	examin	ation of one candidate	each (20 to 30 minute	es) or		
c) oral	examin	ation in groups of up to	3 candidates (approx	. 15 minutes per cano	didate) or	
d) log	approx	. 20 pages) or				
e) pres	entatio	n (approx. 30 minutes)	d/or English			
Langua						
Alloca	cion of p	Diaces				
Additio	onal info	ormation				
Worklo	oad					
150 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination reg	ulations for teaching-	degree programmes)		
		、 U	<u> </u>	<u> </u>		
Modul	e annea	urs in				
Master	's degr	ee (1 major) Chemistry (2016)			
Master	's degr	ee (1 major) Mathematic	2010) °S (2016)			
Master	's degr	ee (1 major) Computatio	nal Mathematics (201	6)		
Master	's degr	ee (1 major) Functional I	Materials (2016)			
Master	's teach	ning degree Gymnasium	MINT Teacher Educat	ion PLUS. Elite Netwo	ork Bavaria (ENB) (2	016)
Supple	Supplementary course MINT Teacher Education PLUS. Elite Network Bavaria (FNB) (2016)					,
Master	's degr	ee (1 major) Chemistry (2018)	`		
Master	's degr	ee (1 major) Computatio	nal Mathematics (201	9)		
Master	's degr	ee (1 major) Mathematio	cs (2019)			
Master	's teach	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (2	020)
Supple	ementar	y course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2020)	
Master	's degr	ee (1 major) Computatio	nal Mathematics (202	22)		
Master	's degr	ee (1 major) Functional I	Materials (2022)			
Master's w	rith 1 maior	Functional Materials (2022)	JMU Würzburg	generated 19-Apr-2025 • exa	ım. reg. da-	page 53 / 104
	.,-		ta record Maste	er (120 ECTS) Funktionswerkst	offe - 2022	

Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Chemistry (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (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) Master's degree (1 major) Functional Materials (2025)

Module title				Abbreviation		
Numer	Numerical Methods and Programming 08-TCM3-161-m01					
Module	e coord	inator		Module offered by	<u>.</u>	
lecture mie"	r of lec	ture "Programmieren in	Theoretischer Che-	Institute of Physical and Theoretical Chemistry		
ECTS Method of grading Only after succ. compl. of module(s)			npl. of module(s)			
5	nume	rical grade				
Duratio	Duration Module level Other prerequisites					
1 seme	1 semester graduate					
Conten	nts	<u>,</u>				
This module provides an introduction to the fundamentals of programming in theoretical chemistry and discusses its application areas.						
Intend	ed lear	ning outcomes				
Studen as well	nts are a l as to r	able to explain and use name its application are	one of the programmi eas.	ng languages typical	ly used in theoretica	ıl chemistry
Course	es (type	, number of weekly con	tact hours, language –	- if other than Germa	n)	
S (2) +	Ü (2)	· · · · · ·				
Metho ster, in	d of ass format	sessment (type, scope, ion on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
a) writt	en exa	mination (approx, 90 to	180 minutes) or			
b) oral	examir	nation of one candidate	each (20 to 30 minute	s) or		
c) oral	examin	ation in groups of up to	o 3 candidates (approx	. 15 minutes per can	didate) or	
d) log (approx	. 20 pages) or				
e) pres	entatio	n (approx. 30 minutes)	d/or English			
Alleset						
Allocal		JIACES				
 A J J!4! -		4 *				
Additio	nal inf	ormation				
			_			
Worklo	ad					
150 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination reg	gulations for teaching-	degree programmes)		
Module	e appea	ars in				
Master	's degr	ee (1 maior) Chemistry	(2016)			
Master	's degr	ee (1 major) Mathemati	cs (2016)			
Master's degree (1 major) Computational Mathematics (2016)						
Master's degree (1 major) Functional Materials (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master's degree (1 major) Chemistry (2018)						
Master's degree (1 major) Computational Mathematics (2019)						
Master's degree (1 major) Mathematics (2019)						
Master Supple	ementa	ning degree Gymnasiur ry course MINT Teacher	Education PLUS, Elite	ion PLUS, Elite Netwo Network Bavaria (EN	огк ваvarıa (ENB) (2 В) (2020)	020)
Master's w	ith 1 majo	r Functional Materials (2022)	JMU Würzburg ta record Maste	e generated 19-Apr-2025 • exa er (120 ECTS) Funktionswerkst	am. reg. da- coffe - 2022	page 55 / 104

Module title Abbreviation						
Quanti	Quantum Dynamics 08-TCM4-161-m01					
Modul	e coord	inator		Module offered by	<u> </u>	
lecture	r of lect	ture "Quantendynamik'	1	Institute of Physical and Theoretical Chemistry		
FCTS	Metho	nd of grading	Only after succ. con	nl of module(s)		cillistry
5	nume	rical grade				
Durati	n		Other prerequisites			
1 seme	ester	graduate				
Conter	nts					
Time-d diabat	epende ic and a	ent Schrödinger equatio Idiabatic states, non-ac	on, propagators, time-c liabatic dynamics, mix	lependent perturbati ed quantum-classica	ion theory, adiabatic al dynamics.	theorem,
Intend	ed learı	ning outcomes		•	,	
The stu	idents i	oossess knowledge abo	out the time-dependen	t description of the r	nuclear and electron	ic dynamics
in mole in the f	ecules.	Their insight into the m theoretical chemistry.	ethods and the numer	ical realizations allo	w them to carry out a	applications
Course	s (type	, number of weekly con	tact hours, language –	- if other than Germa	ın)	
S (2) +	Ü (2)					
Metho ster, in	d of ass formati	essment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
a) writt	en exa	mination (approx, 90 to	180 minutes) or			
b) oral	examin	ation of one candidate	each (20 to 30 minute	s) or		
c) oral	examin	ation in groups of up to	o 3 candidates (approx	. 15 minutes per can	didate) or	
d) log ((approx	. 20 pages) or				
e) pres	entatio	n (approx. 30 minutes)	d/or English			
Alloca		Jaces				
Additio	onal inf	ormation				
Worklo	nad					
150 h						
Teachi	ng cvcl	e				
Referre	ed to in	LPOI (examination reg	gulations for teaching-	degree programmes)		
Modul	e appea	nrs in				
Master	's degr	ee (1 major) Chemistry	(2016)			
Master	's degr	ee (1 major) Mathemati	cs (2016)			
Master	's degr	ee (1 major) Computatio	onal Mathematics (201	6)		
Master's degree (1 major) Functional Materials (2016)						
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)						
Master	's degr	ee (1 major) Chemistry	(2018)	-)		
Master	Master's degree (1 major) Computational Mathematics (2019)					
Master	Master's degree (1 major) Mathematics (2019)				000)	
Supple	s teach ementar	y course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	отк Баvапа (ENB) (2 В) (2020)	020)
Master's w	vith 1 major	Functional Materials (2022)	JMU Würzburg • ta record Maste	e generated 19-Apr-2025 • exa er (120 ECTS) Funktionswerkst	am. reg. da- toffe - 2022	page 57 / 104

Module title				Abbreviation	
Practic	Practical Course in Programming 10-I-PP-152-m01				10-I-PP-152-m01
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Informatik (Computer	Science)	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	(not) s	successfully completed			
Duratio	on	Module level	Other prerequisites		
		undergraduate			
Conten	ts				
The pro	gramm	ning language Java. Indep	endent creation of si	nall to middle-sized	, high-quality Java programs.
Intende	ed lear	ning outcomes			
The stu	dents a	are able to independently	/ develop small to mi	ddle-sized, high-qua	ality Java programs.
Course	s (type	, number of weekly conta	ct hours, language —	· if other than Germa	n)
P (6)					
Metho	d of ass	essment (type, scope, la	nguage — if other tha	an German, examina	tion offered — if not every seme-
ster, in	formati	on on whether module ca	an be chosen to earn	a bonus)	
written	exami	nation (approx. 60 to 120	minutes).		
lf anno	unced	by the lecturer at the beg	inning of the course,	the written examina	tion may be replaced by an oral
examin	ation c	of one candidate each (ap	prox. 20 minutes) or	an oral examination	in groups of 2 candidates (ap-
prox. 1	5 minut	es per candidate).			
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teachi	ng cycl	e			
Teachir	ng cycle	e: every semester			
Referre	d to in	LPOI (examination regu	lations for teaching-o	legree programmes)	
§ 49 I N	Ir. 1 c)				
§691N	lr. 1 d)				
Module	e appea	urs in			
Bachel	or's de	gree (1 major) Computer S	Science (2015)		
Bachel	or's de	gree (1 major) Mathemati	cs (2015)		
Bachel	or's de	gree (1 major) Human-Co	mputer Systems (201	5)	
Bachel	Bachelor's degree (1 major) Computational Mathematics (2015)				
Bachel	or's de	gree (1 major) Aerospace	Computer Science (2 r dograd Baalschuld (2	2015) Computer Science (a	
First sta	ale exa	mination for the teaching	g degree Gymnasium	Computer Science (20	2015)
Master	's degr	ee (1 major) Functional M	aterials (2016)		
Bachel	or's de	gree (1 major) Computer S	Science (2017)		
Master	's degr	ee (1 major) Functional M	aterials (2022)		
Master	's degr	ee (1 major) Functional M	aterials (2025)		

Modul	e title				Abbreviation	
Modelling and Computational Science 10-M-MWR-222-mo1				10-M-MWR-222-m01		
Modul	e coord	inator		Module offered by		
Dean o	of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conter	nts					
Aspect scaling ons, fu near ec	s of ma the mo ndame quation	thematical modelling of odelling, asymptotic serie ntal methods for numeric s.	technical or scientific es, classical methods cal solution of partial	processes. Basic pr for solving ordinary differential equatior	inciples of modelling, aspects of and partial differential equati- ns and the resulting systems of li-	
Intend	ed lear	ning outcomes				
The stu and en	udent m gineeri	nasters the fundamental i ng sciences on a comput	mathematical methoo er.	ls and techniques to	simulate processes from natural	
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)	
V (4) + Module	Ü (2) e taugh	t in: German and/or Engl	ish			
Metho ster, in	d of ass formati	sessment (type, scope, la ion on whether module ca	inguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
a) writt b) oral c) oral Langua Assess credita	en examir examir examin age of a sment o ble for	mination (approx. 90 to 1 nation of one candidate e ation in groups (groups o ssessment: German and, ffered: In the semester ir bonus	80 minutes, usually of ach (15 to 30 minutes of 2, 10 to 15 minutes /or English n which the course is	chosen) or s) or per candidate) offered and in the su	ıbsequent semester	
Allocat	tion of I	places	·			
Additic	nal inf	ormation				
Worklo	bad					
300 h						
Teachi	ng cycl	е				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master	's degr	ee (1 major) Functional M	aterials (2022)			
Bachel	Bachelor's degree (1 major) Mathematical Data Science (2022)					
exchar	nge prog	gram Mathematics (2023				
Bachel	or's de	gree (1 major) Mathemati	cal Physics (2024)			
master	Master's degree (1 major) Functional Materials (2025)					

Module	Module title				Abbreviation		
Imagin	g Meth	ods at the Synchroton			11-BMS-152-m01		
Module	e coord	inator		Module offered by	· · · · · · · · · · · · · · · · · · ·		
Managi	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)	· · · · · · · · · · · · · · · · · · ·		
6	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 seme	ster	undergraduate					
Conten	ts						
Periodi and ima the con energet transfo	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 Radon transform.						
Intende	ed lear	ning outcomes					
The stu applica	dents l itions c	know the principles of on the principles of one of the proce of the pr	ligital image and signa ssing methods and are	l processing. They ki able to apply them	now the ways of fund in practice.	ctioning and	
Course	s (type	, number of weekly con	tact hours, language –	- if other than Germa	n)		
V (3) + Module	R (1) e taugh	t in: German or English					
Methoo ster, inf	l of ass formati	essment (type, scope, on on whether module	language — if other tha can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
c) oral e d) proje e) prese If a writ stead ta of asse nation Langua Assess	 c) oral examination of one candidate each (approx. 30 minutes) of c) oral examination in groups (groups of 2, approx. 30 minutes) 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 						
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
180 h							
Teachir	ng cvcl	6					
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module	e appea	irs in					
Bachelo Bachelo Master Bachelo	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)						
muster 5 WI	an i maju	anetional matchats (2022)	ta record Maste	r (120 ECTS) Funktionswerkst	offe - 2022	page 01 / 104	

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		
Biophy	Biophysical Measurement Technology in Medical Science 11-BMT-161-m01						
Module coordinator			Module offered by				
Manag	ging Dire	ector of the Institute of	stitute of Applied Physics Faculty of Physics and Astronomy				
ECTS	Metho	od of grading	Only after succ. cor	Only after succ. compl. of module(s)			
6	nume	rical grade					
Durati	on	Module level	Other prerequisites	i			
1 seme	ester	graduate					
Conte	nts						
The lea topics sound tal ima	cture co are con and MR age proc	vers the physical princ ventional X-ray technic t-tomography. The lectu essing.	iples of imaging techni Jue, computer tomogra Jure additionally addres	ques and their appli phy, imaging technic ses the systems the	cation in Biomedicin ques of nuclear med ory of imaging syster	e. The main icine, ultra- ms and digi-	
Intend	ed learr	ning outcomes					
The stu dersta image	udents nd the p s.	now the physical print principles of image gen	ciples of imaging techr eration and are able to	iques and their appl explain different teo	ication in Biomedici chniques and interpr	ne. They un- et simple	
Course	es (type,	, number of weekly con	tact hours, language –	– if other than Germa	in)		
V (3) + Modul	R (1) e taugh	t in: German or English					
Metho	d of ass	essment (type, scope,	language — if other th	an German, examina	tion offered — if not	every seme-	
ster, ir	ofrmati	on 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: In the semester in which the course is offered and in the subsequent semester. 							
Alloca	tion of p	olaces					
Additi	onal info	ormation					
Workle	oad						
180 h							
Teachi	ing cycl	e					
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Maste Maste Maste Supple	r's degre r's degre r's teach ementar	ee (1 major) Physics (20 ee (1 major) Functional ning degree Gymnasiur y course MINT Teacher	016) Materials (2016) n MINT Teacher Educat Education PLUS, Elite	ion PLUS, Elite Netw Network Bavaria (EN	ork Bavaria (ENB) (20 B) (2016)	016)	
Master's v	vith 1 major	Functional Materials (2022)	JMU Würzburg ta record Maste	• generated 19-Apr-2025 • exa er (120 ECTS) Funktionswerkst	am. reg. da- toffe - 2022	page 63 / 104	

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

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Functional Materials (2022)

exchange program Physics (2023)

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

Module title					Abbreviation		
Image	Image and Signal Processing in Physics 11-BSV-161-m01						
Modul	e coord	inator		Module offered by			
Manag	ing Dire	ector of the Institute of A	Applied Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	d of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate					
Conter	lts						
Periodi and im convol getic o transfc	ic and a age pro ution pr bservat ormatior	periodic signals; princi cessing; discretisation roduct; tapering functio ion; statistical signals, n.	ples of discreet and ex of signals/sampling the ns and interpolation o image noise, moment	kact Fourier transform heorem (Shannon); h f images; the Parsiva s, stationary signals;	nation; principles of nomogeneous and lin al theorem, correlation tomography: Hanke	digital signal near filters, on and ener- el and Radon	
Intend	ed learr	ning outcomes					
The stu les of i ferent	ıdents ł mage p method	nave advanced knowled rocessing and are famil s and to implement the	lge of digital image an iar with different meth m, especially in the fie	d signal processing. ods of signal proces eld of tomography.	They know the phys sing. They are able t	ical princip- o explain dif-	
Course	s (type,	, number of weekly cont	act hours, language –	- if other than Germa	n)		
V (2) + Module	Ü (2) e taugh	t in: German or English					
Metho	d of ass	essment (type, scope, l	anguage — if other th	an German, examina	tion offered — if not	every seme-	
ster, in	formati	on on whether module	can be chosen to earn	a bonus)			
a) writt b) oral c) oral d) proj e) pres lf a wri stead t of asse nation Langua	 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 						
Allocat	ion of p	olaces					
Additio	onal info	ormation					
Worklo	ad						
180 h	180 h						
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Modul	e appea	rs in					
Master's degree (1 major) Mathematics (2016)							
Master's degree (1 major) Physics (2016)							
Master	's degre	ee (1 major) Nanostructi	ure Technology (2016)				
Master's w	ith 1 major	Functional Materials (2022)	JMU Würzburg • ta record Maste	e generated 19-Apr-2025 • exa er (120 ECTS) Funktionswerkst	am. reg. da- toffe - 2022	page 65 / 104	

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Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Mathematics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (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) Master's degree (1 major) Functional Materials (2025)

Module ti	itle	Abbreviation					
Coating T	Coating Technologies based on Vapour Deposition 11-BVG-202-m01						
Module coordinator			Module offered by				
Managing Director of the Institute of Applied Physics		pplied Physics	Faculty of Physics a	ind Astronomy			
ECTS N	Nethod of grading	Only after succ. con	npl. of module(s)				
5 n	umerical grade						
Duration	Module level	Other prerequisites					
1 semeste	er undergraduate						
Contents							
Physical a on. Applic	and technical basics of PVD a cation of coating materials o	and CVD systems and n an industrial scale.	processes. Layer de	position and layer ch	ıaracterizati-		
Intended	learning outcomes						
The stude industrial	ent has in-depth knowledge i l significance and diversity.	n the field of gas-pha	se deposition proces	sses and gains insigh	nts into their		
Courses ((type, number of weekly cont	act hours, language –	- if other than Germa	ın)			
V (3) + R (Module ta	(1) aught in: German or English						
Method o ster, infor	of assessment (type, scope, l rmation on whether module o	anguage — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-		
d) project e) presen If a writte stead tak of assess nation da Language Assessme creditable	 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	n of places						
	•						
Additiona	al information						
Auditiona							
 Workload		_					
worktoau							
150 n							
Teaching	cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)							
 Module appears in							
Bachelor's degree (1 major) Physics (2020)							
Bachelor's degree (1 major) Nanostructure Technology (2020)							
Bachelor'	Bachelor's degree (1 major) Quantum Technology (2021)						
Master's degree (1 major) Functional Materials (2022)							
exchange	e program Physics (2023)						
Master's	degree (1 major) Functional N	Materials (2025)					
Master's with a	1 major Functional Materials (2022)	JMU Würzburg • ta record Maste	generated 19-Apr-2025 • exa r (120 ECTS) Funktionswerks	am. reg. da- toffe - 2022	page 67 / 104		

Module	e title				Abbreviation	
Compu	Computational Materials Science (DFT) 11-CMS-161-mo1					
Module	e coord	inator		Module offered by		
Manag and As	ing Dire trophys	ector of the Institute of T sics	heoretical Physics	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	Its					
1. Dens 2. Wan 3. Num 4. Hartu 5. Many 6. And 7. Dyna 8. DFT 9. Stroi	 Density functional theory (DFT) Wannier functions and localized basis functions Numerical evaluation of topological invariants Hartree-Fock and static mean-field theory Many-body methods for solid state physics Anderson impurity model (AIM) and Kondo physics Dynamical mean-field theory (DMFT) DFT + DMFT methods for realistic modeling of solids Strongly correlated electrons 					
					· · · ·	
constru the sof serve b me qua (DMFT) ted tran	pool. The participants are introduced to the use of DFT software packages such as VASP or Wien2k and to the construction of maximally localised Wannier functions through the projection of DFT results on atom orbitals with the software wannier90. Furthermore, the students learn how to construct many-particle solutions of AIM and observe border cases such as the Kondo regime. Impurity solvers such as exact diagonalisation or continuous-time quantum Monte Carlo are utilised to solve the self consistency equations of dynamic molecular field theory (DMFT). These steps are necessary to reach the peak of the lecture: a DFT-DMFT calculation of a strongly correlated transition metal oxide such as SrVO3.					
Course	s (type	, number of weekly cont	act hours, language –	- if other than Germa	in)	
V (4) + Module	R (2) e taugh	t in: German or English				
Methor ster, in	d of ass formati	sessment (type, scope, l on on whether module	anguage — if other th can be chosen to earn	an German, examina a bonus)	ition 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: In the semester in which the course is offered and in the subsequent semester 						
Allocation of places						
Additio	onal inf	ormation				
WORKIO	ad					
240 h						
Master's w	ith 1 majo	r Functional Materials (2022)	JMU Würzburg • ta record Maste	er (120 ECTS) Funktionswerkst	am. reg. da- toffe - 2022	page 68 / 104

Teaching cycle

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

Module appears in Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (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) Master's degree (1 major) Functional Materials (2025)

Module title					Abbreviation	
Advand	ced Con	nputer Tomography			11-CTA-212-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	its				(cT) : :	11 41 *
This ad medica on to v ting the ty of st gebraid ny thes ror sou images	This advanced course focuses on the details of modern computed tomography (CT), which is employed both in medical and industrial imaging applications. In addition to the technicalities of CT systems and their application to various tasks in engineering and medical science, this lecture emphasizes on the mathematics of "inverting the Radon transform". Starting with the simple Filtered Back Projection method which is applied to a variety of standard recording geometries (parallel, fan, cone, helix) the advanced course lays out the strategies for algebraic reconstruction techniques (ART) along with many types of regularization schemes which may accompany these methods. Students will have the opportunity to see how Radon data is recorded and how different error sources as well as the corresponding correction schemes influence the outcome of the reconstructed volume images. Finally, the most common tools for volume image analysis are presented, such as distance transforms.					
waters	heds, la	abelling and fiber orier	tation analysis.			
The stu		ing outcomes	mouted tomography (C	D and its annlisation	. From the formula	tion of the
basic in solutio firm im any we	nverse ns, bas pressio	problem posed by this ed on Fourier analysis on (first-hand experien- red reconstruction.	technique the students and/or based on proba ce) of the various sourc	s are able to derive s ability theory. Most in es of measurement o	trategies for differer mportantly the stude errors in CT which ca	nt numerical ents have a n impede
Course	s (type	, number of weekly cor	itact hours, language –	- if other than Germa	ın)	
V (3) + Module	R (1) e taugh	t in: German or English				
Metho ster, in	d of ass formati	e ssment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	ition 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 						
Allocat	ion of p	olaces				
Additional information						
Workload						
180 h						
Teaching cycle						
Master's w	ith 1 majo	Functional Materials (2022)	JMU Würzburg • ta record Maste	generated 19-Apr-2025 • exa r (120 ECTS) Funktionswerkst	am. reg. da- toffe - 2022	page 70 / 104

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

Module appears in

Master's degree (1 major) Physics (2020) Master's degree (1 major) Functional Materials (2022) exchange program Physics (2023)

Module title					Abbreviation		
Electro	n and lo	on Microscopy			11-EIM-211-m01		
Module	e coord	nator		Module offered by			
Manag	ing Dire	ctor of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
6	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	ts						
Theore trons a ced cor	Theoretical Foundations. Electron and ion sources, optics of charged particles, interaction of matter with elec- trons and charged particles, detectors, measurement principles: SEM, STEM, TEM, sample preparation, advan- ced contrast mechanisms: EBSD, EELS, EDS, cathodoluminescence.						
Intende	ed learr	ing outcomes					
The stu and ins electro	ident ha strumer n micro	as specific and immers Ital basics and princip scopy and their applic	ed knowledge in electries of detectors and con ations. He/she knows	on and ion microsco ntrast mechanisms. I ongoing developmer	py. He/she knows th He/she knows differ Its in this field.	າe theoretical ent modi of	
Course	s (type,	number of weekly cor	itact hours, language –	- if other than Germa	n)		
V (3) + Module	R (1) e taught	t in: German or English					
Metho ster, in	d of ass formati	essment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
e) pres lf a writ stead t of asse nation Langua Assess	entatio entatio tten exa ake the essment date at age of a ment o	n/talk (approx. 8 to 10 pag n/talk (approx. 30 min imination was chosen form of an oral examin is changed, the lectur the latest. ssessment: German ar ffered: In the semester	utes). as method of assessm nation of one candidate rer must inform student nd/or English in which the course is	ent, this may be chan e each or an oral exa s about this by four offered and in the su	nged and assessmer mination in groups. weeks prior to the or ubsequent semester	nt may in- If the method riginal exami-	
Allocat	ion of p	laces					
Additio	onal info	ormation					
Worklo	ad						
180 h							
Teachi	ng cycle	9					
Teachi	ng cycle	e: annually, after annoi	uncement				
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020) Master's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Functional Materials (2022) exchange program Physics (2023)							
Master's w	ith 1 major	Functional Materials (2022)	JMU Würzburg • ta record Maste	e generated 19-Apr-2025 • exa er (120 ECTS) Funktionswerkst	am. reg. da- offe - 2022	page 72 / 104	


Module title Abbreviation						
Princip	oles of E	nergy Technologies			11-ENT-152-m01	
Modul	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
Conter	its	graduate				
Physic as rene ting ma studen verters Electric	al princ ewable aterials its. Ene . Nucle city. Bio	iples of energy conservers resources of energy. W , selective layers, highl rgy conservation via th ar power plants. Hydro mass. Geothermal energ	vation and energy conv e also discuss aspects y activated carbons). T ermal insulation. Thern electricity. Wind turbin ergy. Energy storage. En	ersion, energy transp of optimising mater he course is especia nodynamic energy ef es. Photovoltaics. So lergy transport	oort and energy stora ials (e.g. nanostructu lly suitable for teach ficiency. Fossil fired olar thermal: Heat. So	age as well ured insula- ing degree energy con- olar thermal:
Intend	ed lear	ning outcomes				
The stu port ar	udents l nd stora	know the principles of ge. They understand th	different methods of er ne structures of corresp	nergy technology, esponding installations	pecially energy conv and are able to com	ersion, trans- pare them.
Course	s (type	, number of weekly cor	ntact hours, language –	- if other than Germa	ın)	
V (3) + Modul	R (1) e taugh	t in: German or English				
Metho	d of ass	essment (type, scope,	language — if other th	an German, examina	ition offered — if not	everv seme-
ster, in	formati	on on whether module	can be chosen to earn	a bonus)		
a) writh b) oral c) oral d) proj e) pres If a wri stead t of asse nation Langua	en examin examin ect repo entatio tten exa take the essmen date at age of a sment o	mination (approx. 90 to ation of one candidate 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, wi	o 120 minutes) or e each (approx. 30 minu s of 2, approx. 30 minu res) or utes) as method of assessm nation of one candidate rer must inform student nd/or English nter semester	utes) or ites per candidate) o ent, this may be cha e each or an oral exa ts about this by four	r nged and assessmer mination in groups. weeks prior to the or	nt may in- If the method riginal exami-
Allocat	tion of p	olaces				
	_					
Additio	onal inf	ormation				
Worklo	oad					
180 h						
Teachi	Teaching cycle					
Referre § 22 § 22 § 22 § 22	Referred to in LPO I (examination regulations for teaching-degree programmes) § 22 II Nr. 1 h) § 22 II Nr. 2 f) § 22 II Nr. 3 f)					
Modul	e appea	ars in				
Bachel	or's de	gree (1 major) Physics	(2015)			
Master's w	ith 1 majo	r Functional Materials (2022)	JMU Würzburg • ta record Maste	• generated 19-Apr-2025 • exa er (120 ECTS) Funktionswerkst	am. reg. da- toffe - 2022	page 74 / 104

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)

Module	e title				Abbreviation
Solid S	Solid State Physics 2 11-FK2-201-m01				
Module	e coord	inator		Module offered by	
Managi	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)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Approval from exam	ination committee re	equired.
Conten	ts				
 Elect a. Elect b. Bloc c. Elect 2. Semi a. Elect b. Ferm c. Elect d. Boltz 3. The c a. Macr b. Polat plasmotic. Ferro 4. Semi a. Char b. Intrin c. Dopetical d. Physical e. Hete 5. Magria. Atom b. Dia- c. Ferro 6. Supetia. Atom b. Dia- c. Ferro 6. Supetia. Phenometry b. Mod c. Tunn 	rons in trical ar h theor crons i-classi trical tra- trical tra- t	a periodic potential - the od thermal transport em cal models of dynamic pri ansport in partially and co ces; measurement techni ansport in external magne equations of transport ic function and ferroelect c function and ferroelect c electrodynamics and m ty of solids, of lattices, of er-band transitions, Want tism ctors tics niconductors conductors l applications of p-n junc tures and paramagnetism ramagnetism in metals tism uctivity uperconductivity eriments und applications	e band structure rocesses ompletely filled band iques etic fields trics icroscopic theory valence electrons ar nier-Mott excitons	ls nd quasi-free electro	ns; optical phonons, polaritons,
Intende	ed learı	ning outcomes			
Knowle ciples a	edge of and wit	effects, concepts and mo h applications of experim	odels in advanced so nental methods.	lid state physics. Far	niliarity with the theoretical prin-
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)
V (4) + Module	R (2) e taugh	t in: German or English			
Method ster, in	d of ass formati	e ssment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
a) writt b) oral c) oral o d) proje e) prese If a writ stead ta	en exar examin examin ect repo entatio tten exa ake the	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ort (approx. 8 to 10 pages n/talk (approx. 30 minut amination was chosen as form of an oral examina	20 minutes) or ach (approx. 30 minu of 2, approx. 30 minu o) or es). method of assessme tion of one candidate	utes) or tes per candidate) of ent, this may be char e each or an oral exa	r nged and assessment may in- mination in groups. If the method

Master's with 1 major Functional Materials (2022)	
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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: In the semester in which the course is offered and in the subsequent semester

Allocation of places

--

Additional information

--

Workload

240 h

Teaching cycle

--

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

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Module appears in

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

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

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

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

Master's degree (1 major) Computational Mathematics (2022)

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

Master's degree (1 major) Mathematics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (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	title				Abbreviation
Opto-Electronic Material Properties					11-FU-MOE-161-m01
Module	coord	inator		Module offered by	
Managi	ng Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Physica	al princ	iples of optoelectronic m	aterial properties and	l applications	
Intende	ed learn	ning outcomes			
The stu	dents	know the principles of op	toelectronic material	characteristics.	
Courses	s (type,	, number of weekly conta	ct hours, language —	if other than Germa	n)
V (3) + Í Module	Ü (1) taugh	t in: Ü: German or English	1		
Method	l of ass formati	essment (type, scope, la	nguage — if other tha	an German, examina a bonus)	tion offered — if not every seme-
c) oral e d) proje e) prese If a writ stead ta of asse nation o Langua	examin ect repo entatio ten exa ake the ssment date at ge of a	ation in groups (groups of ort (approx. 8 to 10 pages n/talk (approx. 30 minute amination was chosen as form of an oral examinat t is changed, the lecturer the latest. ssessment: German and/	of 2, approx. 30 minut of 2, approx. 30 minut of assessme tion of one candidate must inform student /or English	tes per candidate) or ent, this may be char each or an oral exar s about this by four v	r nged and assessment may in- mination in groups. If the method weeks prior to the original exami-
Allocat	ion of p	olaces			
Additio	nal info	prmation			
 Worklo					
150 h	au				
Teachir	ng cycl	2			
Referre	Referred to in LPO L (examination regulations for teaching-degree programmes)				
			0		
Module	appea	irs in			
Master'	s degre	ee (1 major) Functional M	aterials (2016)		
Master'	s degre	ee (1 major) Functional M	aterials (2022)		
Master'	s degre	ee (1 major) Functional M	aterials (2025)		

Module title				Abbreviation	
Mecha	nical ar	nd Thermal Material Prop	erties		11-FU-MTE-161-m01
Module	e coord	inator		Module offered by	
Manag	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Physica	al laws	of solids: Bonding and st	ructure, lattice dynar	nics, thermal and m	echanical properties.
Intende	ed learr	ning outcomes			
The stu	dents ł	nave knowledge of mech	anical/thermal mater	ial characteristics.	
Course	s (type,	, number of weekly conta	ct hours, language —	if other than Germa	n)
V (3) +	Ü (1)				
Module	e taugh	t in: Ü: German or Englisł	1		
Method ster, in	l of ass formati	e ssment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
b) oral c) oral d d) proje e) pres If a writ stead t of asse nation Langua Allocat	examin examin ect repo entatio ten exa ake the ssmen date at ge of a ion of p	ation of one candidate e ation in groups (groups of ort (approx. 8 to 10 pages n/talk (approx. 30 minut amination was chosen as form of an oral examina t is changed, the lecturer the latest. ssessment: German and, blaces	ach (approx. 30 minu of 2, approx. 30 minut of or es) method of assessme tion of one candidate must inform student /or English	tes) or tes per candidate) of ent, this may be char each or an oral exa s about this by four	r nged and assessment may in- mination in groups. If the method weeks prior to the original exami-
Additio	nal inf	ormation			
Worklo	ad				
150 h					
Teachi	ng cycl	9			
Referre	d to in	LPO I (examination regu	lations for teaching-c	legree programmes)	
				<u> </u>	
Module	e appea	ins in			
Master	's degre	ee (1 major) Functional M	aterials (2016)		
Master	's degre	ee (1 major) Functional M	aterials (2022)		
Master	's degre	ee (1 major) Functional M	aterials (2025)		

Module	e title				Abbreviation
Semiconductor Lasers and Photonics				11-HLF-152-m01	
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	pl. of module(s)	
6	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
This lee rent de model, hold co riers ar des, la ductor cade la	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-				
Intend	ed learr	ning outcomes			
The stu knowle	idents l dge to	nave advanced knowledg modern questions and ki	e of the principles of now the applications	semiconductor-lase	r physics. They can apply their opment of components.
Course	s (type,	, number of weekly conta	ct hours, language –	· if other than Germa	n)
V (3) + Module	R (1) e taught	t in: German or English			·
Metho	d of ass	essment (type, scope, la	nguage — if other tha	an German, examina	tion offered — if not every seme-
ster, in	formati	on on whether module ca	an be chosen to earn	a bonus)	
a) writt b) oral c) oral d) proj- e) pres lf a wri- stead t of asse nation Langua Assess	en exar examin examin ect repo entatio tten exa ake the essment date at age of a ment o	nination (approx. 90 to 1 ation of one candidate e ation in groups (groups c ort (approx. 8 to 10 pages n/talk (approx. 30 minute amination was chosen as form of an oral examina- t is changed, the lecturer the latest. ssessment: German and/ ffered: Once a year, sum	20 minutes) or ach (approx. 30 minu of 2, approx. 30 minu of or es). method of assessme tion of one candidate must inform student /or English mer semester	ites) or tes per candidate) of ent, this may be char e each or an oral exa s about this by four	r nged and assessment may in- mination in groups. If the method weeks prior to the original exami-
Allocat	ion of p	olaces			
Additio	onal info	ormation			
Worklo	ad				
180 h					
Teachi		2			
	-3 -9 -10	-			
Referre	ed to in	LPOI (examination regu	lations for teaching.	legree programmes)	
				segree programmes)	
Modul	a annoa	rs in			
Bachel	e appea	us III Tree (1 major) Dhusics (as	215)		
Dachel	u s ueg	siee (1 major) Physics (20	712)		

Master's with 1 major Functional Materials (2022)

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	e title				Abbreviation	
Optica	l Prope	rties of Semiconductor N	anostructures		11-HNS-161-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
or mac ging th tures o with a t of nove for qua	Semiconductor nanostructures are frequently referred to as "artificial materials". In contrast to atoms, molecules or macroscopic crystals, their electronic, optical and magnetic properties can be systematically tailored by chan- ging their size. The lecture addresses technological challenges in the preparation of semiconductor nanostruc- tures of varying dimensions (2D, 1D, oD). It provides the basic theoretical concepts to describe their properties, with a focus on optical properties and light-matter coupling. Moreover, it discusses the challenges and concepts of novel optoelectronic and quantum photonic devices based on such nanostructures, including building blocks for quantum communication and quantum computing architectures.					
Intend	ed learı	ning outcomes				
The stu knowle devices	Idents l dge of s. They	know the theoretical prin the technological methor are able to apply their kn	ciples and characteri ds to fabricate such s owledge to problems	stics of semiconduc structures, and of the s in this field of rese	tor nanostructures. They have eir applications to novel photonic arch.	
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	ın)	
V (3) + Module	R (1) e taugh	t in: German or English				
Metho	d of ass	sessment (type, scope, la	nguage — if other th	an German, examina	tion offered — if not every seme-	
ster, in	formati	on on whether module ca	an be chosen to earn	a bonus)		
a) writt b) oral c) oral d) proje e) pres If a writ stead t of asse nation Langua Assess	a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English					
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
180 h						
Teachi	ng cvcl	e				
	0 . 7	-				
Referre	ed to in	LPOI (examination regu	lations for teaching-	degree programmes)		
Modula	annos	urs in				
Master	's degr	ee (1 major) Mathematics	(2016)			
master	Juegn	ce (I major) mathematics	(2010)			

Master's with 1 major Functional Materials (2022)

Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Mathematics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (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) Master's degree (1 major) Functional Materials (2025)

Module title					Abbreviation	
Semico	onducto	or Physics			11-HPH-201-m01	
Module	e coord	inator		Module offered by	<u>.</u>	
Manag	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. cor	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 seme	ester	graduate				
Conten	nts					
The lec	ture de	als with the fundament	tal properties of semic	onductors. It begins	with an analysis of t	he crystal
tronic	properti	ies of monolithic semic	conductors. It then turn	s to examining semi	conductor heterostru	uctures, and
studies	s how tl	nese can be used to mo	odify and design optica	al and electrical prop	erties, especially in t	the case of
lowere	d dime	nsionality systems. Exa	mples are selected fro	m current research a	ctivities.	
Intend	ed lear	ning outcomes				
To pro	vide the	e student with a working	g knowledge semicond	luctors pertaining to	crystal structure, syr	nmetries,
the mo	ore targe	eted specially lectures i	in the program.		s a solid basis prep	anng mini ior
Course	es (type	number of weekly con	tact hours, language -	- if other than Germa	n)	
V (3) +	R (1)	,				
Module	e taugh	t in: German or English				
Metho	d of ass	sessment (type, scope,	language — if other th	an German, examina	tion offered — if not	every seme-
ster, in	formati	on on whether module	can be chosen to earn	a bonus)		
a) writt	ten exai	mination (approx. 90 to) 120 minutes) or			
c) oral	examin	ation of one candidate	s of 2, approx, 30 minu	utes) or ites per candidate) o	r	
d) proj	ect repo	ort (approx. 8 to 10 pag	es) or			
e) pres	entatio	n/talk (approx. 30 min	utes).			
If a write	tten exa	amination was chosen of orm of an oral examin	as method of assessm	ent, this may be chai	nged and assessmei mination in groups	nt may in- If the method
of asse	essmen	t is changed, the lectur	er must inform studen	ts about this by four	weeks prior to the o	riginal exami-
nation	date at	the latest.		,	•	5
Langua	age of a	ssessment: German an	id/or English	offered and in the c	beaquant competer	
Allocat	tion of			onereu anu în the st	insequent semester	
Allocal		Jiaces				
Auditit						
 Workle						
180 h						
Toochi		•				
Teacin	ing cycl	e				
Deferre	d to in	IDOL (avamination ro		dagraa pragrammac)		
Referre				uegiee piogrammes)		
 Modul		arc in				
Mastor	e appea	us III 99 (1 major) Nanostruct	ture Technology (2020)			
Master	's degr	ee (1 major) Nanostiuci	020)	,		
Master	's teacl	ning degree Gymnasiur	n MINT Teacher Educat	ion PLUS, Elite Netw	ork Bavaria (ENB) (20	020)
Master's w	ith 1 majo	r Functional Materials (2022)	JMU Würzburg	• generated 19-Apr-2025 • exa	am. reg. da-	page 84 / 104
			ta record Maste	er (120 ECTS) Funktionswerkst	offe - 2022	

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Mathematics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (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)

Modul	e title				Abbreviation	
Labora	tory an	d Measurement Techn	ology in Biophysics		11-LMB-152-m01	
Modul	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on octor	Module level	Other prerequisites	i		
Conter	its	graduate				
The lec physic measu metho	ture co al proce ring tec ds of st	vers relevant principle edures for the examina hniques and sensors, ructure elucidation of b	s of molecular and cell tion and manipulation methods of single-part piomolecules.	ular biology as well a of biological system icle detection, specia	s the physical princi s. The main topics an al microscoping tech	ples of bio- re optical iniques and
Intend	ed learı	ning outcomes				
The stu sical p measu biomol	udents rocedur ring tec lecules.	know the principles of es for the examination hniques and their app	molecular and cellular and manipulation of b lications and are able t	biology as well as th iological systems. Th o apply techniques o	e physical principles ney have knowledge of structure elucidati	; of biophy- of optical on to simple
Course	s (type	number of weekly cor	itact hours, language –	- if other than Germa	n)	
V (3) + Module	R (1) e taugh	t in: German or English				
Metho ster, in	d of ass formati	essment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
b) oral c) oral d) proj e) pres lf a wri stead t of asse nation Langua	examin examin ect repo eentatio tten exa cake the essmen date at age of a	ation of one candidate ation in groups (group ort (approx. 8 to 10 pag n/talk (approx. 30 min mination 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 minu s of 2, approx. 30 minu res) or utes). as method of assessm nation of one candidate rer must inform student nd/or English mmer semester	ates) or tes per candidate) o ent, this may be cha e each or an oral exa ts about this by four	r nged and assessmer mination in groups. weeks prior to the or	nt may in- If the method riginal exami-
Allocat	tion of r	laces				
Additio	onal inf	ormation				
Worklo	ad					
180 h						
Teachi	ng cycl	9				
Referre	ed to in	LPOI (examination re	gulations for teaching-	degree programmes)		
		•	<u> </u>	<u> </u>		
Modul	e appea	rs in				
Bachel Bachel Master	or's deg or's deg 's degre	gree (1 major) Physics gree (1 major) Nanostru ee (1 major) Functional	(2015) ucture Technology (201 Materials (2016)	5)		
Master's w	rith 1 major	Functional Materials (2022)	JMU Würzburg ta record Maste	e generated 19-Apr-2025 • exa er (120 ECTS) Funktionswerkst	am. reg. da- coffe - 2022	page 86 / 104

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)

Modul	e title				Abbreviation	
Labora	tory an	d Measurement Techn	ology		11-LMT-152-m01	
Modul	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	undergraduate				
Conter	its					
Introdu nics, c	uction to ryogeni	o electronic and optica cs, light sources, spec	l measuring methods o troscopic methods and	f physical metrology measured value acq	, vacuum technology uisition.	/ and cryoge-
Intend	ed learı	ning outcomes				
The stu vacuur quisitio	udents l n techn on.	nave competencies in to ology and cryogenics,	the field of electronic a cryogenics, light source	nd optical measuring es, spectroscopic me	g methods of physica thods and measured	al metrology, d value ac-
Course	s (type	, number of weekly cor	ntact hours, language –	- if other than Germa	n)	
V (3) + Modul	R (1) e taugh	t in: German or English	I			
Metho ster, in	d of ass formati	e ssment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
d) proj e) pres If a wri stead t of asse nation Langua Assess	ect repo entatio tten exa ake the essmen date at age of a sment o	ort (approx. 8 to 10 pag n/talk (approx. 30 min amination was chosen form of an oral exami t is changed, the lectur the latest. ssessment: German ar ffered: Once a year, wi	ges) or utes). as method of assessm nation of one candidate rer must inform student nd/or English nter semester	ent, this may be cha e each or an oral exa ts about this by four	nged and assessmer mination in groups. weeks prior to the or	nt may in- If the method riginal exami-
Allocat	tion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
180 h						
Teachi	ng cvcl	6				
	<u> </u>	-				
Referre	d to in	IPOI (examination re	gulations for teaching.	degree programmes)		
Keren						
Modul	e annea	rs in				
Bachel	or's de	gree (1 major) Physics	(2015)			
Bachel	or's de	gree (1 major) Nanostri	ucture Technology (201	5)		
Bachel	Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015)					
Master	's degr	ee (1 major) Functional	Materials (2016)			
Bachel	or's de	gree (1 major) Physics	(2020)			
Bachel	or's de	gree (1 major) Nanostri	ucture Technology (202	o)		·
Master's w	uth 1 majoi	Functional Materials (2022)	JMU Würzburg • ta record Maste	• generated 19-Apr-2025 • exa er (120 ECTS) Funktionswerkst	am. reg. da- offe - 2022	page 88 / 104

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	e title				Abbreviation	
Nanote	echnolo	gy in Energy Research			11-NTE-152-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten						
proces and str cal con accum cuum i	echnolo ses or a ructures itexts. I ulators, nsulatio	gy is of great significar applications by using s that have optimised p t uses specific materia functional nanoscale ons and electrode mate	nce for energy research pecial functional mater properties due to effect and components as layer and particle syste erials.	Energy efficiency car rials. This module co s of nanotechnology examples, such as the ems with spectral sel	an be heightened in vers special materia . It explains the unde nermal insulation ma ective properties, na	numerous ls, surfaces erlying physi- aterials, heat inoporous va-
Intend	ed learı	ning outcomes				
The stu researd They a	idents l ch. They re able	nave specific and adva v know methods of nan to apply their knowleds	nced knowledge of the otechnology to influen ge to specific questions	application of nano ce the properties of s.	technology in the fie materials and their a	ld of energy pplications.
Course	s (type	, number of weekly con	tact hours, language –	- if other than Germa	ın)	
V (3) + Module	R (1) e taugh	t in: German or English				
Metho	d of ass	essment (type, scope,	language — if other th	an German, examina	ition offered — if not	every seme-
ster, in	formati	on on whether module	can be chosen to earn	a bonus)		,
a) writt b) oral c) oral d) proj e) pres lf a wri stead t of asse nation Langua	a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may in- stead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original exami- nation date at the latest. Language of assessment: German and/or English					
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
180 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination reg	gulations for teaching-	degree programmes)		
Module	e appea	in				
Bachel Bachel	or's de or's de	gree (1 major) Nanostru gree (1 major) Nanostru	icture Technology (201 icture Technology (202	5) 0)		
Master's w	ith 1 major	Functional Materials (2022)	JMU Würzburg ta record Maste	e generated 19-Apr-2025 • exa er (120 ECTS) Funktionswerks	am. reg. da- toffe - 2022	page 90 / 104

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						
Organi	c Semi	conductors		-	11-OHL-161-m01	
Module	o coord	inator		Modulo offered by	<u> </u>	
Module			nuliad Dhuaita			
Manag	ing Dire	ector of the institute of P		Faculty of Physics a	nd Astronomy	
ECIS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Fundan	nentals	of organic semiconduc	tors, molecular and po	olymer electronics ar	nd sensor technology	y, applicati-
Intende	ad loar	ing outcomes				
The stu	donte k	ang outcomes	ao of organic comicon	ductors		
The stu			ge of organic semicon		``	
Course	s (type,	, number of weekly cont	act hours, language –	- if other than Germa	n)	
V (3) + Module	R (1) e taugh ⁻	t in: German or English				
Method	d of ass	essment (type, scope, l	anguage — if other th	an German, examina	tion offered — if not	every seme-
ster, in	formati	on on whether module	can be chosen to earn	a bonus)		
a) writt	en exar	mination (approx. 90 to	120 minutes) or			
b) oral	examin	ation of one candidate	each (approx. 30 minu	ites) or		
c) oral	examin	ation in groups (groups	of 2, approx. 30 minu	tes per candidate) o	r	
a) proje	ect repo	ort (approx. 8 to 10 page	(s) or			
If a writ	tten exa	mination was chosen a	s method of assessme	ent this may be chai	nged and assessme	nt may in-
stead t	ake the	form of an oral examin	ation of one candidate	e each or an oral exa	mination in groups.	If the method
of asse	ssmen	t is changed, the lecture	er must inform student	s about this by four	weeks prior to the or	riginal exami-
nation	date at	the latest.				
Langua	ige of a	ssessment: German and	l/or English			
Assess	ment o	ffered: In the semester	n which the course is	offered and in the su	ibsequent semester	
Allocat	ion of p	olaces				
Additio	onal info	ormation				
Worklo	ad					
180 h						
Teachi	ng cycl	e				
			_			
Referre	ed to in	LPOI (examination reg	ulations for teaching-o	degree programmes)		
Module	e appea	irs in				
Master	's degre	ee (1 major) Physics (20	16)			
Master	's degre	ee (1 major) Nanostructi	ure Technology (2016)			
Master	's degre	ee (1 major) Functional I	Materials (2016)			
Master	's teacł	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netw	ork Bavaria (ENB) (2	016)
Supple	mentar	y course MINT Teacher	Education PLUS, Elite	Network Bavaria (EN	B) (2016)	
Master	's degre	ee (1 major) Nanostructi	re Technology (2020)			
Master	's degre	ee (1 major) Physics (20	20)			、 、
Master	's teach	ning degree Gymnasium	MINT Teacher Educat	ion PLUS, Elite Netw	ork Bavaria (ENB) (2	020)
Master's w	ith 1 major	Functional Materials (2022)	JMU Würzburg • ta record Maste	generated 19-Apr-2025 • exa r (120 ECTS) Funktionswerkst	am. reg. da- coffe - 2022	page 92 / 104



Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Functional Materials (2022) exchange program Physics (2023) 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 title				Abbreviation			
Physics of Advanced Materials 11-PMM-161-m01							
Module coordinator				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	pl. of module(s)			
6	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	its						
Genera and su groups	General properties of various material groups such as liquids, liquid crystals and polymers; magnetic materials and superconductors; thin films, heterostructures and superlattices. Methods of characterising these material groups: two-dimensional layer materials.						
Intende	ed learı	ning outcomes					
The stu	ıdents l	know the properties and	characterization met	hods of some moder	n materials.		
Course	s (type	, number of weekly conta	ict hours, language –	- if other than Germa	n)		
V (3) + Module	R (1) e taugh	t in: German or English					
Metho ster, in	d of ass formati	e ssment (type, scope, la on on whether module c	inguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
 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: In the semester in which the course is offered and in the subsequent semester 							
Allocal		naces	<u>.</u>				
Additional information							
Workload							
Referred to in LPO L (examination regulations for teaching-degree programmes)							
Module appears in							
Master's degree (1 major) Mathematics (2016)							
Master's degree (1 major) Physics (2016)							
Master's degree (1 major) Nanostructure Technology (2016)							
Master	's degr	ee (1 major) Computation	al Mathematics (201	6)			
Master	's degr	ee (1 major) Functional M	laterials (2016)				
Master	's teacl	ning degree Gymnasium I	MINT Teacher Educat	ion PLUS, Elite Netwo	ork Bavaria (ENB) (20	016)	
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)							
Master's w	ith 1 major	Functional Materials (2022)	JMU Würzburg • ta record Maste	generated 19-Apr-2025 • exa r (120 FCTS) Funktionswerkst	am. reg. da-	page 94 / 104	

Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Mathematics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (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) Master's degree (1 major) Functional Materials (2025)

Module title			Abbreviation			
Quantum Transport 11-QTH-161-m01						
Module coordinator				Module offered by		
Manag	Managing Director of the Institute of Applied Physics			Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. compl. of module(s)			
6	numei	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
The lec topics of phenor transpo	The lecture addresses the fundamental transport phenomena of electrons in nanostructures. This includes the topics of: ballistic and diffuse transport, electron interference effects, quantisation of conductivity, interaction phenomena between electrons, Coulomb blockade, thermoelectric properties, description of spin-dependent transport phenomena, topological insulators, solid-state quantum computers.					
Intende	ed learr	ning outcomes				
The stu ons and	dents h d applie	nave mastered the basi cations of respective co	cs of electronics of natomponents.	nostructures in theor	y and practice. They	know functi-
Course	s (type,	number of weekly con	tact hours, language –	- if other than Germa	n)	
V (3) + Module	R (1) e taught	t in: German or English				
Methoo ster, in	d of ass formati	essment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every 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 						
Allocation of places						
Additional information						
Workload						
180 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Mathematics (2016)						
Master's degree (1 major) Physics (2016)						
Master	s aegre	ee (1 major) Nanostruci	ure rechnology (2016)	6)		
Master	s uegre 's degre	e (1 major) Computational	Materials (2016)	0)		
Master's with 1 major Functional Materials (2022) JMU Würzburg • generated 19-Apr-2025 • exam. reg. da-						
		. ,	ta record Maste	r (120 ECTS) Funktionswerkst	offe - 2022	

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Functional Materials (2025)

Modul	e title	Abbreviation				
Physics of Semiconductor Devices 11-SPD-152-m01						
Modul	e coordinator		Module offered by			
Manag	ing Director of the Institute of Ap	oplied Physics	Faculty of Physics a	nd Astronomy		
ECTS	ECTS Method of grading Only after succ. compl. of module(s)					
6	numerical grade					
Durati	on Module level	Other prerequisites	Other prerequisites			
1 seme	ester undergraduate					
Conter	its					
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 examples. The basic part introduces the crystal structures and band and phonon dispersions of technologically relevant 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 components, 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-dimensional 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 properties. 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 familiar with the theories of planar technology and recent developments in this field, they have a basic understanding of component production. They understand the structure and way of functioning of the main components of						
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 seme- 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 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, 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 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)

Module title					Abbreviation		
Principles of Two- and Three-Dimensional Röntgen Imaging					11-ZDR-152-m01		
Module coordinator			Module offered by				
Managing Director of the Institute of Applied Physics		Applied Physics	Faculty of Physics a	nd Astronomy			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ster	graduate					
Conten	its						
Physics ton abs project traction charac	Physics of X-ray generation (X-ray tubes, synchrotron). Physics of the interaction between X-rays and matter (pho- ton absorption, scattering), physics of X-ray detection. Mathematics of reconstruction algorithms (filtered rear projection, Fourier reconstruction, iterative methods). Image processing (image data pre-processing, feature ex- traction, visualisation,). Applications of X-ray imaging in the industrial sector (component testing, material						
Intend	ed learr	ning outcomes					
The stu technic	idents l ques us	know the principles of ing X-rays and method	generating X-rays and o Is of image processing	of their interactions v as well as applicatio	vith matter. They kno n areas of these met	ow imaging hods.	
Course	s (type,	number of weekly cor	ntact hours, language –	- if other than Germa	n)		
V (3) + Module	R (1) e taugh	t in: German or English					
Metho ster, in	d of ass formati	essment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
 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 (2015)							
Bachelor's degree (1 major) Nanostructure Technology (2015) Master's degree (1 major) Functional Materials (2016) Bachelor's degree (1 major) Physics (2020)							
Master's w	ith 1 major	Functional Materials (2022)	JMU Würzburg	generated 19-Apr-2025 • exa	am. reg. da-	page 100 / 104	
			ta record Maste	er (120 ECTS) Funktionswerkst	offe - 2022		

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		
Methods of Non-Destructive Material Testing 11-ZMB-152-m01						
Module coordinator			Module offered by			
Managi	ng Dire	ctor of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	d of grading	Only after succ. con	npl. of module(s)		
4	numer	ical grade				
Duratio	n	Module level	Other prerequisites	i		
1 semes	ster	undergraduate				
Content	ts					
Principl Ultrasou	es of n und. Oj	on-destructive materia otical testing, laser. Im	al and component testin age processing.	ng. Thermography. N	eutron radiography.	X-ray testing.
Intende	d learn	ing outcomes				
The stud on (hea thods fo problem	dents h t, X-ray or the d ns of m	nave basic knowledge , terahertz), particles letection of radiation t aterial testing and cha	of the generation and i (neutrons) or ultrasoun ypes, particles and ultr aracterisation.	nteraction processes d waves with materia asound waves and a	s of different types of als. They know the a re able to apply ther	f radiati- pplied me- n to basic
Courses	s (type,	number of weekly cor	ntact hours, language –	- if other than Germa	in)	
V (2) + F Module	R (1) taught	: in: German or English				
Method	of ass	essment (type, scope,	language — if other th	an German, examina	tion offered — if not	every seme-
ster, inf	ormati	on on whether module	can be chosen to earn	a bonus)		-
 c) oral examination in groups (groups of 2, approx. 30 minutes) of 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 						
Allocation of places						
Additional information						
Workloa	ad					
120 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 degre	ee (1 major) Functional	Materials (2016)			
Bachelo	or's deg	gree (1 major) Physics	(2020)			
Bachelo	or's deg	gree (1 major) Nanostri	ucture Technology (202	o)		
Master's wit	th 1 major	Functional Materials (2022)	JMU Würzburg ta record Maste	e generated 19-Apr-2025 • exa er (120 ECTS) Funktionswerkst	am. reg. da- toffe - 2022	page 102 / 104

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		
Materials f	or High Voltage insulation a	and High Voltage Sys	tems	99-HIS-222-m01		
Module co	ordinator		Module offered by			
Dean of the Faculty of Electrical Engineering at the Universi- ty of Applied Sciences Würzburg-Schweinfurt			University of Applied Sciences Würzburg- Schwein- furt (FHWS)			
ECTS Method of grading Only after succ. co			pl. of module(s)			
5 nu	nerical grade					
Duration Module level Other prerequis			35			
1 semester	graduate					
Contents						
Electrical s rials and sy	tress, electrical strength, die stems, diagnostics, measu	electric material propered at the proper term of the proper term of the property of the proper	erties, technology an and tests of insulatir	nd application of insulating mate- ng systems.		
Intended le	arning outcomes					
The studen terials. The knowledge	d gain basic knowledge abo y can design simple insulat in the field of diagnosis and	out the electrical field ing systems by their c d technology of insula	and insulating syste wn and approve the ating materials.	ems with layering of different ma- e existing design. They have basic		
Courses (ty	pe, number of weekly conta	ict hours, language —	if other than Germa	n)		
V (3) + Ü (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) written examination (approx. 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes total) Language of assessment: German and/or English						
Allocation of places						
Additional information						
Workload						
150 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's de	Master's degree (1 major) Functional Materials (2022)					
Master's degree (1 major) Functional Materials (2025)						