

Subdivided Module Catalogue for the Subject

Physics

as Unterrichtsfach with the degree "Erste Staatsprüfung für das Lehramt an Mittelschulen"

> Examination regulations version: 2020 Responsible: Faculty of Physics and Astronomy

JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record L7|128|-|-|H|2020

Learning Outcomes

German contents and learning outcome available but not translated yet.

Wissenschaftliche Befähigung

- Die Absolventinnen und Absolventen verstehen die konzeptionellen und experimentellen Grundlagen der Physik und können diese anwenden.
- Die Absolventinnen und Absolventen können unter Anleitung Experimente durchführen, analysieren und die erhaltenen Ergebnisse darstellen und bewerten.
- Die Absolventinnen und Absolventen setzen die erlernten physikalischen Methoden und Konzepte unter Anleitung zur Erlangung neuer Erkenntnisse ein.
- Die Absolventinnen und Absolventen sind in der Lage, physikalische Probleme durch Anwendung der wissenschaftlichen Arbeitsweise und unter Beachtung der Regeln guter wissenschaftlicher Praxis (Dokumentation, Fehleranalyse) zu bearbeiten.
- Die Absolventinnen und Absolventen können ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darstellen und vertreten.
- Die Absolventinnen und Absolventen können ein breites Grundlagenwissen aus den wichtigsten Teilgebieten der Physik abrufen.
- Die Absolventinnen und Absolventen verstehen die wesentlichen Zusammenhänge und Konzepte der einzelnen Teilgebiete der Physik.
- Die Absolventinnen und Absolventen sind in der Lage, sich mit Hilfe von Fachliteratur punktuell in neue Aufgabengebiete einzuarbeiten, physikalische und physikdidaktische Methoden unter Anleitung auf konkrete Aufgabenstellungen anzuwenden.
- Die Absolventinnen und Absolventen besitzen Abstraktionsvermögen und sind in der Lage komplexe Zusammenhänge zu strukturieren.
- Die Absolventinnen und Absolventen können Konzepte, Prinzipien, Methoden und evidenzbasierte Erkenntnisse aus dem Bereich der Physikdidaktik interpretieren und anwenden.
- Die Absolventinnen und Absolventen können den Einsatz von Experimenten und Medien im Physikunterricht und die Betreuung von Schülerinnen und Schülern an ausgewählten Lehr-Lernsituationen wissenschaftlich fundiert reflektieren.

Befähigung zur Aufnahme einer Erwerbstätigkeit

- Die Absolventinnen und Absolventen können fachliche Inhalte und ihre Erkenntnisse didaktisch aufbereiten und adressatengerecht vermitteln.
- Die Absolventinnen und Absolventen sind in der Lage physikalische und physikdidaktische Methoden unter Anleitung auf konkrete Aufgabenstellungen anzuwenden, Lösungswege zu entwickeln und die Ergebnisse zu interpretieren und zu bewerten.
- Die Absolventinnen und Absolventen kennen Konzepte, Prinzipien, Methoden und evidenzbasierte Erkenntnisse aus dem Bereich der Physikdidaktik und können diese zur ziel- und adressatengerechten Ausgestaltung von Lehr/Lern-Settings anwenden.
- Die Absolventinnen und Absolventen besitzen die Kompetenz zur Gestaltung eines modernen und zeitgemäßen Physikunterrichts unter Verwendung von passenden Medien und Methoden.
- Die Absolventinnen und Absolventen sind in der Lage Experimente zur Verdeutlichung physikalischer Sachverhalte selbstständig fachgerecht aufzubauen & durchzuführen. Sie verwenden dabei reflektiert die geeigneten analogen oder digitalen Verfahrensweisen.
- Die Absolventinnen und Absolventen besitzen ein breites Spektrum digitaler Grundkompetenzen (Anwendungssoftware, Computergestützte Datenaufnahme & -analyse, Programmiergrundlagen)

Persönlichkeitsentwicklung

• Die Absolventinnen und Absolventen kennen die Regeln guter wissenschaftlicher Praxis und beachten sie.

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- Die Absolventinnen und Absolventen können ihr Wissen und ihre Erkenntnisse in einer Lehrsituation angemessen und selbstbewusst darstellen und vertreten.
- Die Absolventinnen und Absolventen besitzen ein ausgeprägtes Durchhaltevermögen beim Umgang mit wissenschaftlichen und lehrbezogenen Herausforderungen.
- Die Absolventinnen und Absolventen besitzen die Fähigkeit ihr didaktisches Wirken in der Lehr-/ Lernsituation angemessen zu reflektieren und passende Konsequenzen zu ziehen.

Befähigung zum gesellschaftlichen Engagement

UNIVERSITÄT

WÜRZBURG

- Die Absolventinnen und Absolventen können naturwissenschaftliche Entwicklungen im Kontext Bildung für nachhaltige Entwicklung kritisch reflektieren und deren Auswirkungen auf die Wirtschaft, Gesellschaft und die Umwelt in Ansätzen erfassen.
- Die Absolventinnen und Absolventen haben ihr Wissen bezüglich wirtschaftlicher, gesellschaftlicher, naturwissenschaftlicher, kultureller etc. Fragestellungen erweitert und können begründet Position beziehen.
- Die Absolventinnen und Absolventen entwickeln die Bereitschaft und Fähigkeit, ihre Kompetenzen in partizipative Prozesse einzubringen und aktiv an Entscheidungen mitzuwirken.

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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:

LASPO2015

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

19-Feb-2020 (2020-20)

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.

LA Mittelschulen	Physics	(2020)	
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The subject is divided into

Abbroviation	Modulo titlo	ECTS	Method of	nago		
Abbreviation	Module lille	credits	grading	page		
Scientific Discipline (54 E	CTS credits)					
Compulsory Courses (54 ECTS credits)						
Classical Physics (23 E	CTS credits)					
11-E-M-152-m01	Classical Physics 1 (Mechanics)	8	NUM	12		
11-E-E-152-m01	Classical Physics 2 (Heat and Electromagnetism)	8	NUM	9		
11-L-OW-172-m01	Optics and Waves	7	NUM	33		
Structure of material (1	11 ECTS credits)		•			
11-L-M1-NV-172-m01	Modern Physics 1	6	NUM	30		
11-L-M2-NV-172-m01	Modern Physics 2	5	NUM	32		
Computational Method	ls (6 ECTS credits)					
11-M-MR-202-m01	Mathematical Methods of Physics	6	B/NB	47		
Laboratory Course I (9	ECTS credits)		1			
11-P-LA-152-m01	Laboratory Course Physics A(Mechanics, Heat, Electromagne- tism)	2	B/NB	53		
11-P-FR1-152-m01	Data and Error Analysis	2	B/NB	51		
11-P-LB-152-m01	5	B/NB	55			
Laboratory Course II (5	ECTS credits)					
11-P-DP1-172-m01	Demonstration Laboratory Course 1	5	NUM	49		
Teaching (12 ECTS credits	5)		Į			
Compulsory Courses (12	ECTS credits)					
11-L-PD-172-m01	Physics Teaching Concepts	5	NUM	35		
11-L-PDS-NV-152-m01	Physics Teaching Concepts Seminar	2	B/NB	37		
11-L-L3S-152-m01	Student Lab Preparation Course (Physics)	5	NUM	28		
Thesis (4 ECTS credits)			I			
Students studying for a teach gy (studienbegleitendes fach Fach (subject studied with a f regulations for teaching-degre ECTS credits obtained are cou neral academic and examinat	ing degree Mittelschule must complete a practical training in did didaktisches Praktikum) which refers to one of the subjects they ocus on the scientific discipline) pursuant to Section 34 Subsec ee programmes). The obligatory accompanying tutorial is offered inted in the subject Erziehungswissenschaften pursuant to Sect ion regulations for teaching-degree programms).	dactics and selected a tion 1 No. A by the res ion 10 Sub	d teaching meth as vertieft studi 4 LPO I (examin spective subjec section 3 LASP	nodolo- ertes ation t. The O (ge-		
11-L-SBPMS-152-m01	Physics: Practical Training and Theory of Classroom	4	B/NB	38		
Extra Skills Teaching degree students mu ject-specific electives) (Section To achieve the required numb Freier Bereich interdisciplin nex "Ergänzende Bestimmung	st take modules worth a total of 15 ECTS credits in the area Freie on 9 LASPO (general academic and examination regulations for t per of ECTS credits, students may take any modules from the are ary: The interdisciplinary additional offer for a teaching degree of gen für den "Freien Bereich" im Rahmen des Studiums für ein Le	er Bereich (eaching-de as below. an be four hramt".	general as well egree programr nd in the respec	as sub- nes)). ctive An-		
Physics (Freier Bereich (general as w	ell as subject-specific electives) subject specific)					
11-L-EL1-152-m01	Teaching Seminar Fundamental Principles	3	B/NB	21		
11-L-EL2-152-m01	Selected Topics in Physics Didactics	3	B/NB	23		
11-P-VKM-202-m01	MINT Preparatory Course Mathematical Methods of Physics		B/NB	57		
11-L-L3B-152-m01	Student Lab Supervision (Physics)	2	B/NB	26		
11-MIND-Ph1-152-m01	Low Cost - High Impact. Low-budget Experiments for Science Courses (Physics)	2	B/NB	43		
11-MIND-Ph2-152-m01	Teaching Science with Hands-on-Exhibits (Physics)	2	B/NB	45		
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11-AP-152-m01	Astrophysics	6	NUM	7
11-ENT-152-m01	Principles of Energy Technologies	6	NUM	15
11-L-APD-152-m01	Current Topics of Teaching Concepts in Physics	3	NUM	17
11-L-WPD-152-m01	Scientific Work in Teaching Concepts	3	B/NB	39
11-LX6-152-m01	Current Topics in Physics	6	NUM	41
11-LCS6-152-m01	Selected Topics of Physics	4	NUM	19

Thesis (10 ECTS credits)

Preparation of a written Hausarbeit (thesis) in accordance with the provisions of Section 29 LPO I (examination regulations for teaching-degree programmes) is a prerequisite for teaching degree students to be admitted to the Erste Staatsprüfung (First State Examination). In accordance with the provisions of Section 29 LPO I, students studying for a teaching degree Mittelschule may write this thesis in the subject Didaktik einer Fächergruppe der Mittelschule (Didactics of a Group of Subjects of Mittelschule), in the subject they selected as Unterrichtsfach (subject studied with a focus on the scientific discipline) or in the subject Erziehungswissenschaften (Educational Science). Pursuant to Section 29 Subsection 1 Sentence 2 LPO I, students may also choose to write an interdisciplinary thesis.

11-L-HA-MS-UF-152-m01	Thesis in Physics Secondary General School	10	NUM	25
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Module	title				Abbreviation	
Astrophysics				11-AP-152-m01		
Module coordinator				Module offered by		
Managing Director of the Institute of Theoretical Physics and Astrophysics			heoretical 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	n	Module level	Other prerequisites			
1 semes	ster	undergraduate				
Content	ts					
History telesco um, mo lactic nu	of astr pes an lecular uclei, la	onomy, coordinates and d detectors, stellar struc clouds, structure of the arge-scale structures, co	time measurement, t ture and atmosphere milky way, the local u psmology.	he Solar System, exc s, stellar evolution a universe, the expand	oplanets, astronomic nd end stages, inters ling universe, galaxie	al scales, stellar medi- es, active ga-
Intende	ed learn	ning outcomes				
The stue physica ons. The laxies.	dents a Il obse ey are f	are familiar with the moo rvations and evaluation: familiar with the physics	dern world view of Ast s. They are able to use s and development of	rophysics. They know these methods to p the main astrophysic	w methods and tools lan and analyse own cal objects such as s	for astro- observati- tars and ga-
Courses	s (type,	, number of weekly cont	act hours, language –	if other than Germa	n)	
V (2) + F Module	R (2) taugh	t in: German or English				
Method ster, inf	l of ass formati	essment (type, scope, l on on whether module o	anguage — 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) proje e) prese If a writt stead ta of asses nation o Languas	 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. 					
Allocati	ion of r	olaces				
Additio	nal info	ormation				
			_			
Worklo	he		_			
190 h	uu					
Teeshir						
	ig cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
§ 22 N § 22 N § 22 N	Nr. 1 h) Nr. 2 f) Nr. 3 f)					
Module appears in						
Bachelo	or's deg	gree (1 major) Physics (2	015)			
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Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) First state examination for the teaching degree Grundschule Physics (2015) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2015) First state examination for the teaching degree Realschule Physics (2015) First state examination for the teaching degree Gymnasium Physics (2015) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2015) First state examination for the teaching degree Mittelschule Physics (2015) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2015) Bachelor's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2018) First state examination for the teaching degree Realschule Physics (2018) First state examination for the teaching degree Gymnasium Physics (2018) First state examination for the teaching degree Mittelschule Physics (2018) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2018) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2018) Master's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2020) First state examination for the teaching degree Grundschule Physics (2020) First state examination for the teaching degree Gymnasium Physics (2020) First state examination for the teaching degree Realschule Physics (2020) First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Physics (2020) Master's degree (1 major) Quantum Technology (2021) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

Module title				Abbreviation		
Classical Physics 2 (Heat and Electromagnetism)				11-E-E-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)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate	Admission prerequi	site to assessment:	completion of exerci	ses (approx.
			13 exercise sheets p	oer semester). Stude	nts who successfully	/ completed
			approx. 50% of exe	rcises will qualify for	admission to asses	sment. The
			lecturer will inform	students about the re	espective details at	the beginning
			of the semester.			
Conten	ts					
1. Ther	modyna	amics (linked to 11-E-M); temperature and qua	ntity of heat, thermo	ometer, Kelvin scale;	
2. Heat	condu	ction, heat transfer, di	ffusion, convection, rac	liant heat;		
3. Fund	lament	al theorems of thermo	dynamics, entropy, irrev	versibility, Maxwell's	demon;	
4. Heat	engine	es, working diagrams, e	eniciency, example: Sti nattor (also solids), var	ning engine; Maala critical n	oint phaco transitio	one critical
phenoi	gases nena (d	and ilquids, states of n malescence), coexiste	nce region. Joule-Thom	son:	ionit, phase transitio	Jiis, chiicai
6. Elect	trostati	cs, basic concepts: Ele	ctrical charge, forces; e	electric field, reps. fie	eld concept, field lin	es, field of a
point c	harge;	, ,	<i>,</i>	<i>,</i> ,		
7. Gaus	ssian se	entence, related to Cou	llomb's law, definition	of "river"; Gaussian s	surface, divergence t	theorem; spe-
cial syr	nmetrie	es; divergence and GS	in differential form;		1 .	
8. Elect	trical p	otential, working in the	E-box, electric. potent	ial, potential differer	ice, voltage; potenti	al equation,
lace ef	fects S	egner wheel.	intaint examples: Sphere	e, notiow sphere, cap	Jacitor plates, electr	ic uipole;
9. Matt	er in th	e E-field, charge in a h	omogeneous field, Mill	ikan experiment, Bra	aun tube; electron: F	ield emissi-
on, the	rmioni	c emission, dipole in h	omogeneous and inhor	nogeneous field; ind	luction, Faraday cag	e;
10. Cap	oacitor,	mirror charge, definition	on, capacity; plate and	spherical capacitor;	combination of cap	acitors; me-
dia in t	he cap	acitor; electrical polari	sation, displacement a	nd orientation polari	sation, microscopic	image; diel-
ectric c		ement; electrolytic cap	acitor; Piezoelectric eff	ect; anduction mochanics	m c .	
11. Elec	istance	and conductivity resi	stivity, and velocity, co	nduction mechanisi	115; N: realisations (resid	tive and non-
ohmic.	NTC. P	TC):	stivity, temperature de	pendence, onin s la		
13. Circ	uits, el	ectrical networks, Kircl	hhoff's rules (meshes, i	nodes); internal resis	stance of a voltage s	ource, mea-
suring	instrun	ients; Wheatstone bric	lge;		0	·
14. Pov	ver and	energy in the circuit; (Capacitor charge; galva	nic element; thermov	voltage;	
15. Trai	nsfer m	echanisms, conduction	n in solids: Band mode	l, semiconductor; lin	e in liquids and gas	es;
16. Ma	gnetosi fiold. A	atics, fundamental lav	vs; permanent magnet,	field properties, def	initions and units; E	arth's ma-
17 Vec	tor not	ential formal derivation	n analogous to electri	swiii; scalar notential· ca	lculation of fields	vamples
Helmh	oltz coi	ls:		scalar potential, ca		xumptes,
18. Mo	ving ch	arge in the static magr	etic field, current balar	nce, Lorentz force, rig	ght-hand rule, electr	ic motor; di-
pole fie	eld; mo	vement paths, mass s	pectrometer, Wien filter	s, Hall effect; electro	on: e / m determinat	ion;
19. ma	tter in t	he magnetic field, effe	cts of the field on matte	er, relative permeabi	lity, susceptibility; p	ara-, dia-,
ferrom	agnetis	m; magn. moment of t	he electron, behaviour	at interfaces;	field Weltenbefen	n on dulum.
induct:	20. Induction, Faraday's law of induction, Lenz's rule, flux change, eddy electric field, Waltenhofen's pendulum;					
21. Max	muuciance, seit-muucion; applications: mansionnel, generation; 21. Maxwell's displacement current, choice of integration area, displacement current. Maxwell's extension, wave					
equation	on; Max	well equations;			,,	,
22. AC:	Funda	mentals, sinusoidal vil	orations, amplitude, pe	riod and phase; pow	ver and RMS value, o	hmic resi-
stance	; Capac	itive & inductive resist	or, capacitor and coil, I	phase shift and frequ	uency dependence; i	impedance:
Comple	ex resis	tance; performance of	the AC;			
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23. Resonant circuits, combinations of RLC; series and parallel resonant circuit; forced vibration, damped harmonic oscillator (related to 11-E-M);

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

Intended learning outcomes

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

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

V (4) + Ü (2)

Module taught in: Ü: German or English

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

written examination (approx. 120 minutes)

Language of assessment: German and/or English

Allocation of places

Additional information

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

Workload

240 h

Teaching cycle

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

§ 53 | Nr. 1 a)

§ 77 | Nr. 1 a)

Module appears in

Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) First state examination for the teaching degree Grundschule Physics (2015) First state examination for the teaching degree Realschule Physics (2015) First state examination for the teaching degree Gymnasium Physics (2015) First state examination for the teaching degree Mittelschule Physics (2015) Bachelor's degree (1 major) Mathematical Physics (2016) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Realschule Physics (2018) First state examination for the teaching degree Gymnasium Physics (2018) First state examination for the teaching degree Mittelschule Physics (2018) Bachelor's degree (1 major) Physics (2020) LA Mittelschulen Physics (2020) JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

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

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Module title			Abbreviation				
Classic	al Phys	sics 1 (Mechanics)			11-E-M-152-m01		
Module	e coord	inator		Module offered by			
Manag	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	·		
8	nume	rical grade	'	1			
Duratio	n	Modula laval	Other proroquisites				
1 como	stor	undorgraduato	Admission proroqui	sito to assossment.	completion of exercises (approx		
1 Seme	5101	undergraduate	Aumission prerequi	or competer) Stude	ats who successfully completed		
			13 exercise sheets p	iel Selliestel). Studel	its who successfully completed		
			approx. 50% of exer	cises will quality for	admission to assessment. The		
			lecturer will inform s	students about the re	espective details at the beginning		
			of the semester.				
Conten	ts						
1. Princ	iples: F	Physical quantities, prefa	ctors, derived quanti	ties, dimensional an	alysis, time / length / mass (de-		
finition	, meas	urement procedures, SI),	importance of metro	logy;			
2. Poin	t Mech	anics: Kinematics, motio	n in 2D and 3D / vect	ors, special cases: U	niform and constant accelerated		
motion	, free fa	all, slate litter; circular mo	otion in polar coordin	iates;			
3. New	ton's la	ws: Forces and momentu	im definition, weight	vs. mass forces on t	he pendulum, forces on an ato-		
MIC SCa	ale, Isol	ropic and anisotropic me	ction. Preparation of i	the equations of mot	lion and solutions;		
4. WOIN	ic inol	astic and super-plastic co	nice, examples;	nomentum concerva	tion surges in centre of mass		
and ha	lance s	vstem rocket equation.	Suision. Energy and n	nomentum conserva	tion, surges in centre of mass		
6. Cons	servativ	e and non-conservative f	Force fields: Potential	. potential energy: la	w, weight scale, field strength		
and po	tential	of gravity (general relatio	ns);	,	,		
7. Rota	tional r	notion: Ángular momentu	um, angular velocity,	torque, rotational en	ergy, moment of inertia, analo-		
gies to	linear t	ranslation, applications,	satellites (geostation	nary and interstellar)	, escape velocities, trajectories		
in the c	entral	potential;					
8. Tida	l forces	: Inertial system, referend	ce systems, apparent	forces, Foucault per	ndulum, Coriolis force, centrifu-		
gai ioro	.e; oan tra	nsformation. Brief digres	sion to Maxwell's eq	ustions other Mich	alson interferometer Finstein's		
9. Gain	ean lia ates nr	oblem of simultaneity 1 c	ventz transformation	time dilation and le	angth contraction relativistic im-		
nulse:	ites, pr	obtem of simulation, ec					
10. Rigi	d bodv	and gyroscope: Determi	ning the centre of ma	ss. inertia tensor an	d -ellipsoid, principal axes and		
their st	ability,	tensor on the example of	f the elasticity tensor	, physics of the bike	; gyroscope: Precession and nu-		
tation,	the Ear	th as a spinning top;	,				
11. Frict	tion: St	atic and dynamic friction	, stick-slip motion, ro	lling friction, viscous	s friction, laminar flow, eddy for-		
mation	;						
12. Vib	ration:	Representation by means	s of complex e-function	on, equation of moti	on (DGL) on forces, torque and		
powera	approa	ch, Taylor expansion, har	monic approximation	n; spring and pendul	um, physical pendulum, damped		
vibratio	on (reso	onant case, Kriechfall, ap	eriodic limit), forced	vibration, Fourier and	alysis;		
13. COU	pied vi	brations: Eigenvalues an	a eigenfunctions, ao	uble pendulum, dete	erministic vs. chaotic motion,		
		idinics and chaos;	and longitudinal way	os polarisation prir	ciple of superposition reflection		
14. Way	14. waves: wave equation, transverse and tongitudinal waves, potarisation, principle of superposition, reflection						
relation	at the open and closed end, speed of sound; interference, poppler enect; phase and group velocity, dispersion relation.						
15. Elas	stic def	ormation of solid bodies:	Elastic modulus, ger	neral Hooke's law, el	astic waves:		
16. Flui	ds: Hyd	lrostatic pressure and bu	ioyancy, surface tens	ion and contact angl	e, capillary forces, steady flows,		
Bernou	lli equa	ation; Boyle-Mariotte, gas	s laws, barometric he	ight formula, air pres	ssure, compressibility and com-		
pressiv	e modu	ılus;			-		
17. Kine	etic the	ory of gases: ideal and re	eal gas, averages, dis	tribution functions, o	equipartition theorem, Brownian		
motion	, collisi	on cross section, mean f	ree path, diffusion ar	nd osmosis, degrees	of freedom, specific heat		

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	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	1

Intended learning outcomes

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

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

V (4) + Ü (2)

Module taught in: Ü: German or English

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

written examination (approx. 120 minutes)

Language of assessment: German and/or English

Allocation of places

--

Additional information

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

Workload

240 h

Teaching cycle

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

§ 53 | Nr. 1 a)

§ 77 | Nr. 1 a)

Module appears in

Bachelor's degree (1 major) Physics	(2015)					
Bachelor's degree (1 major) Nanostru	ucture Technology (2015)					
Bachelor's degree (1 major) Mathem	atical Physics (2015)					
Bachelor's degree (1 major, 1 minor)	Physics (Minor, 2015)					
First state examination for the teach	ng degree Grundschule Physics (2015)					
First state examination for the teach	ng degree Realschule Physics (2015)					
First state examination for the teach	ng degree Gymnasium Physics (2015)					
First state examination for the teach	ng degree Mittelschule Physics (2015)					
Bachelor's degree (1 major) Mathem	atical Physics (2016)					
First state examination for the teach	ng degree Grundschule Physics (2018)					
First state examination for the teach	ng degree Realschule Physics (2018)					
First state examination for the teach	ng degree Gymnasium Physics (2018)					
First state examination for the teach	ng degree Mittelschule Physics (2018)					
Bachelor's degree (1 major) Physics	(2020)					
Bachelor's degree (1 major) Nanostru	ucture Technology (2020)					
Bachelor's degree (1 major) Mathem	Bachelor's degree (1 major) Mathematical Physics (2020)					
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)						
First state examination for the teaching degree Grundschule Physics (2020)						
First state examination for the teaching degree Gymnasium Physics (2020)						
First state examination for the teach	First state examination for the teaching degree Realschule Physics (2020)					
LA Mittelschulen Physics (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data re- cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	page 13 / 58				

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

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

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	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Module	e title				Abbreviation	
Principles of Energy Technologies 11-ENT-152-mo1						
Module	e coordi	inator		Module offered by		
Manag	ing 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)		
6	numer	ical grade				
Duratio	n at a r	Module level	Other prerequisites			
1 Seme	ster ts	graduate				
Physical principles of energy conservation and energy conversion, energy transport and energy storage as well as renewable resources of energy. We also discuss aspects of optimising materials (e.g. nanostructured insula- ting materials, selective layers, highly activated carbons). The course is especially suitable for teaching degree students. Energy conservation via thermal insulation. Thermodynamic energy efficiency. Fossil fired energy con- verters. Nuclear power plants. Hydroelectricity. Wind turbines. Photovoltaics. Solar thermal: Heat. Solar thermal: Electricity. Biomass. Geothermal energy. Energy storage. Energy transport						
The stu	dents k	now the principles of	lifferent methods of er	nergy technology, esp	pecially energy conve	ersion, trans-
port an	d stora	ge. They understand th	e structures of corresp	onding installations	and are able to com	pare them.
Course	s (type,	number of weekly con	tact hours, language –	- if other than Germa	n)	
V (3) + Module	R (1) e taughi	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, in	formati	on on whether module	can be chosen to earn	a bonus)		
a) writt b) oral c) oral d d) proje e) press If a writ stead t of asse nation Langua Assess	en exar examin examin ect repo entation ten exa ake the ssment date at ge of a ment of	nination (approx. 90 to 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 is changed, the lectur the latest. ssessment: German ar ffered: Once a year, wi	120 minutes) or each (approx. 30 minu s of 2, approx. 30 minu es) or utes) as method of assessme tation of one candidate er must inform student d/or English nter semester	utes) or tes per candidate) or ent, this may be char e each or an oral exa ts about this by four y	r nged and assessmer mination in groups. I weeks prior to the or	ıt may in- f the method iginal exami-
Allocat	ion of p	laces				
Additio	nal info	ormation				
Worklo	ad					
180 h	180 h					
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
§ 22 § 22 § 22	Nr. 1 h) Nr. 2 f) Nr. 3 f)					
Module	appea	rs in				
Bachel	or's deg	gree (1 major) Physics (2015)			
LA Mittelsc	hulen Phys	sics (2020)	JMU Würzburg • g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	. reg. data re- 'hysik - 2020	page 15 / 58

UNIVERSITÄT WÜRZBURG

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

Module title				Abbreviation		
Curren	Current Topics of Teaching Concepts in Physics 11-L-APD-152-mo1					
Modul	e coordi	inator		Module offered by		
chairpe	erson of	examination committ	ee	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
3	numer	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	undergraduate				
Conter	nts					
Curren	t topics	in physics education.				
Intend	ed learr	ing outcomes				
The stu red kno	udents h owledge	nave knowledge of a cu according to subject-	irrent subdiscipline of specific contexts and i	physics education ar	nd are able to classif	y the acqui-
Course		number of weekly cor	tact hours language -	- if other than Germa	(n)	
Course	3 (type,		liaci nours, language –		iii <i>)</i>	
S (2) Module	e taught	t in: German or English				
Metho ster, in	d of ass Iformati	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	ten exar	nination (approx, 45 m	inutes) or			
b) oral	examin	ation of one candidate	each (approx. 10 minu	ıtes) or		
c) oral	examin	ation in groups (group	s of 2, approx. 10 minu	tes per candidate) o	r	
d) term	n paper	(approx. 8 pages) or				
e) talk	(30 to 4	5 minutes) with discus	sion			
Allocat	tion of p	laces				
Additio	onal info	ormation				
Worklo	oad					
90 h						
Teachi	ng cycle	2				
Referre	ed to in	LPOI (examination re	gulations for teaching-	degree programmes)		
§ 22	Nr. 1 h)					
§ 22	Nr. 2 f)					
§ 22	Nr. 3 f)					
Modul	e appea	rs in				
First st	ate exai	nination for the teachi	ng degree Grundschule	e Physics (2015)		
First st	ate exai	mination for the teachi	ng degree Grundschule	e Didactics in Physics	s (Primary School) (2	2015)
First state examination for the teaching degree Realschule Physics (2015)						
First state examination for the teaching degree Gymnasium Physics (2015)						
First St	ate exal	mination for the teach	ng degree Mittelechuld	Physics (2015)		51) (2015)
First st	ate exa	mination for the teaching	ng degree Mittelschule	Didactics in Physics	s (Middle School) (20	015)
First st	ate exa	mination for the teaching	ng degree Grundschule	e Physics (2018)		<i>- 1</i>
First st	ate exai	mination for the teachi	ng degree Grundschule	e Didactics in Physics	s (Primary School) (2	2018)
First st	ate exai	mination for the teachi	ng degree Realschule F	Physics (2018)	, , , , , , , , , , , , , , , , , , , ,	·
First st	ate exai	mination for the teachi	ng degree Gymnasium	Physics (2018)		
LA Mittelso	chulen Phys	sics (2020)	JMU Würzburg • g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	1. reg. data re- Physik - 2020	page 17 / 58

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) 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 Realschule Physics (2020) First state examination for the teaching degree Mittelschule 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 Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2020)

LA Mittelschulen Physics (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data re-	page 18 / 58
	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Module title			Abbreviation			
Selecte	Selected Topics of Physics 11-LCS6-152-m01					
Module	e coord	inator		Module offered by		
chairpe	erson o	f examination committ	ee	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate	Approval from exam	ination committee re	equired.	
Conten	ts					
Current study a	Current topics in experimental physics. Credited academic achievements, e.g. in case of change of university or study abroad.					
Intend	ed learr	ning outcomes				
The stu sics of unders classify	idents h the Bac tand th / the su	nave advanced compet helor's programme. Th e measuring and/or ev bject-specific contexts	encies corresponding t ney have knowledge of valuation methods nece and know the applicat	to the requirements of a current subdiscipli essary to acquire this ion areas.	of a module of Exper ne of Experimental F 5 knowledge. They ar	imental Phy- 'hysics and 'e able to
Course	s (type	, number of weekly cor	itact hours, language –	- if other than Germa	n)	
V (2) +	R (1)					
Metho ster, in	d of ass formati	e ssment (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-
d) proje e) pres If a writ stead t of asse nation Langua	ect repo entatio tten exa ake the essment date at age of a	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	id/or English	ent, this may be char e each or an oral examples about this by four	nged and assessmer mination in groups. weeks prior to the or	nt may in- If the method riginal exami-
Allocat	ion of p	olaces				
Additio	onal info	ormation				
Worklo	ad					
120 h						
Teachi	ng cycl	9				
Referre	ed to in	LPO I (examination re	gulations for teaching-o	degree programmes)		
§ 22 § 22 § 22	Nr. 1 h) Nr. 2 f) Nr. 3 f)		<u> </u>			
Module	e appea	in in				
First sta First sta First sta First sta	ate exa ate exa ate exa ate exa	mination for the teachi mination for the teachi mination for the teachi mination for the teachi mination for the teachi	ng degree Grundschule ng degree Grundschule ng degree Realschule F ng degree Gymnasium	e Physics (2015) e Didactics in Physics Physics (2015) Physics (2015) gogik Didactics in Ph	s (Primary School) (2	.015)
LA Mittelsc	hulen Phy	sics (2020)	JMU Würzburg • g	enerated 19-Apr-2025 • exam	. reg. data re-	page 19 / 58
	,		cord Lehramt Mit	telschulen (Unterrichtsfach) F	Physik - 2020	

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

Module title			Abbreviation			
Teachi	Teaching Seminar Fundamental Principles 11-L-EL1-152-m01					
Module coordinator Module offered by			Module offered by			
holder	of the (Chair of Physics and its	Didactics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)	,	
3	(not) s	successfully completed	1			
Duratic	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	its					
Physica ceptior sed on pical se	al and i 1s and t specifi chool e	nterdisciplinary aspec typical learning difficu c contents of physics e xperiments and suitab	ts of selected topics of ties, elementarisation a education, verbalisatior le media.	physics education, c and didactic reconstr of physical contents	orresponding studer ruction of physical co s, possible teaching	nt precon- ontents ba- methods, ty-
Intendo	ed learı	ning outcomes				
Advanc studen Physics	ced, qua t preco s at uni	alitative knowledge of nceptions and special versity and school rega	school-relevant areas c media on relevant topic arding contents and me	f Physics; knowledg cs; awareness of the thods.	e of common metho differences betweer	ds, typical n teaching
Course	s (type	, number of weekly cor	ntact hours, language –	- if other than Germa	n)	
S (2)						
Methoo ster, in	d of ass formati	essment (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-
c) writte d) oral e) oral Langua	en exar examin examin age of a	nination (approx. 45 m ation of one candidate ation in groups (group ssessment: German at	iinutes) or e each (approx. 15 minu s of 2, approx. 15 minu nd/or English	tes) or tes per candidate)		
		Jaces				
Additic	nal inf	ormation				
Auditio	mathin					
WORKIO	ad					
90 h						
Teachi	ng cycl	e				
	-					
Referre	ed to in	LPOI (examination re	gulations for teaching-o	degree programmes)		
§ 22 § 22 § 22	Nr. 1 h) Nr. 2 f) Nr. 3 f)					
Module	e appea	irs in				
First sta First sta First sta First sta	ate exa ate exa ate exa	mination for the teach mination for the teach mination for the teach	ing degree Grundschule ing degree Grundschule ing degree Realschule F	e Physics (2015) e Didactics in Physics	s (Primary School) (2	015)
First sta First sta First sta	ate exa ate exa ate exa ate exa	mination for the teach mination for the teach mination for the teach mination for the teach mination for the teach	ing degree Gymnasium ing degree Sonderpäda ing degree Mittelschule ing degree Mittelschule	Physics (2015) Physics (2015) gogik Didactics in Ph Physics (2015) Didactics in Physics	nysics (Middle Schoo (Middle School) (20	ol) (2015) 015)

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) First state examination for the teaching degree Grundschule Didactics in Physics (Middle 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 Realschule Physics (2020) First state examination for the teaching degree Realschule Physics (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) First state examination for the teaching degree Mittelschule 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 Didactics in Physics (Middle School) (2020)

Modul	e title				Abbreviation	
Selected Topics in Physics Didactics			11-L-EL2-152-m01			
Module coordinator Module offered by			Module offered by	<u> </u>		
chairn	erson o	f examination committ	<u>۹</u>	Faculty of Physics a	nd Astronomy	
FCTS	Metho	nd of grading	Only after succ. con	nnl. of module(s)	ind Astronomy	
3	(not)	successfully completed				
Durati	on	Module level	Other prerequisites			
1 seme	ester	undergraduate				
Conte	nts					
Curren	t topics	in physics education.				
Intend	ed lear	ning outcomes				
Tho st	udonte l	navo knowlodgo of a ci	urront subdissipling of	nhysics adjustion ar	ad are able to classif	fy the acqui
red kn	owledge	e according to subject-	specific contexts and in	nplement it into clas	ses.	y the acqui-
Course	es (type	number of weekly cor	itact hours, language –	- if other than Germa	n)	
S(2)		,			,	
J (2)	d of acc	accmant (tupa ccapa	languaga if other th	an Carman, avamina	tion offered if not	01/07/ 6070
ster, ir	nformati	on on whether module	can be chosen to earn	a bonus)	tion onered — if not	every seme-
a) term	n naner	(approx, 8 pages) or				
b) pres	sentatio	n (approx. 45 minutes)	or			
c) writ	ten exar	mination (approx. 45 m	inutes) or			
d) oral	examin	ation of one candidate	e each (approx. 15 minu	ites) or		
e) oral	examin	ation in groups (group	s of 2, approx. 15 minu	tes per candidate)		
Langu	age of a	ssessment: German ar	id/or English			
Alloca	tion of p	olaces				
Additi	onal inf	ormation				
Workle	oad					
90 h						
Teachi	ing cycl	e				
Referr	ed to in	LPOI (examination re	gulations for teaching-	degree programmes)		
§ 22	Nr. 1 h)	· ·	<u> </u>	<u> </u>		
§ 22	Nr. 2 f)					
§ 22	Nr. 3 f)					
Modul	e appea	ars in				
First st	tate exa	mination for the teach	ng degree Grundschule	e Physics (2015)		
First st	tate exa	mination for the teach	ng degree Grundschule	e Didactics in Physics	s (Primary School) (2	2015)
First state examination for the teaching degree Realschule Physics (2015)						
First state examination for the teaching degree Gymnasium Physics (2015)						
First st	tate exa	mination for the teach	ng degree Sonderpäda	gogik Didactics in Pł	nysics (Middle Schoo	ol) (2015)
First st	tate exa	mination for the teach	ng degree Mittelschule	Physics (2015)		
First st	tate exa	mination for the teach	ng degree Mittelschule	Didactics in Physics	s (Middle School) (20	015)
First st	tate exa	mination for the teach	ng degree Grundschule	e Physics (2018)		
First st	tate exa	mination for the teach	ng degree Grundschule	e Didactics in Physics	s (Primary School) (2	2018)
First st	tate exa	mination for the teach	ng degree Realschule F	Physics (2018)		
First st	tate exa	mination for the teach	ng degree Gymnasium	Physics (2018)		
LA Mittels	chulen Phy	sics (2020)	JMU Würzburg ● g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	. reg. data re- Physik - 2020	page 23 / 58

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) 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 Realschule Physics (2020) First state examination for the teaching degree Mittelschule 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 Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2020)

A Mittelschulen Physics (2020)	IMU Würzburg • generated 19-Apr-2025 • exam. reg. data re-	page 24 / 58
	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Module	e title				Abbreviation
Thesis in Physics Secondary General School 11-L-HA-MS-UF-152-m01					11-L-HA-MS-UF-152-m01
Module	Module coordinator Module offered by				
chairpe	erson o	f examination committee		Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
		undergraduate			
Conten	ts				
Indepe	ndent p	processing of a topic of P	hysics and/or Didact	ics of Physics, chose	en in consultation with a lecturer.
Intende	ed lear	ning outcomes			
The stu and me	dents a	are able to independently acquired in the teaching	/ work on a predetern degree programme. T	nined physical topic They are able to pres	while applying the knowledge ent their results in written form in
due coi	nsidera	tion of didactic aspects.		.,	
Course	s (type	, number of weekly conta	ct hours, language —	· if other than Germa	n)
No cou	rses as	signed to module			
Methoo 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-
Hausar	beit (th	esis) pursuant to Sectior	n 29 LPO I (examinati	on regulations for te	aching-degree programmes) (ap-
prox. 4	o page	s)			
Langua ons for	ige of a teachi	ssessment: German; exc ng-degree programmes)	eptions pursuant to S	section 29 Subsection	on 4 LPO I (examination regulati-
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
300 h					
Teachi	ng cycl	e			
Referre	d to in	LPOI (examination regu	lations for teaching-c	legree programmes)	
§ 29					
Module	e appea	urs in			
First sta	ate exa	mination for the teaching	g degree Mittelschule	Physics (2015)	
First sta	ate exa	mination for the teaching	degree Mittelschule	Physics (2018)	
First sta	ate exa	mination for the teaching	g degree Mittelschule	Physics (2020)	

Module	e title				Abbreviation	
Studen	Student Lab Supervision (Physics) 11-L-L3B-152-mo1					
Module coordinator Module offered			Module offered by			
holder	of the (Chair of Physics and its I	Didactics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
2	(not) s	successfully completed				
Duratio	on	Module level	Other prerequisites	i i i i i i i i i i i i i i i i i i i		
1 seme	ster	undergraduate				
Conten	ts					
The mo in the t	dule p eachin	rovides an introduction g-learning-laboratory.	to successful supervis	sion of pupils indepe	ndently carrying out	experiments
Intende	ed lear	ning outcomes				
The stuvel of p experir ly and o ve beha terns b control	Idents I perform nenting criticall aviour J y repea compe	earn to classify differen ance, to support the pu g (supervision competen y evaluate their own act patterns and to support tedly working on the sa tencies).	t groups of pupils acc pils according to their icies in open classroo ions. A lecturer gives the students' strength me topic with differen	ording to their subje- needs and age and t m situations). The st individual feedback ns. The students deve t groups of pupils (re	ct-specific and experison help them during udents are able to m to the students to av elop professional be eflection competenci	rimental le- independent iethodical- /oid negati- haviour pat- ies and self-
Course	s (type	, number of weekly cont	act hours, language –	- if other than Germa	n)	
P (2)						
Metho ster, in	d of ass formati	essment (type, scope, l on on whether module o	anguage — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
a) writt b) oral c) oral d) term	en exal examir examin paper	mination (approx. 45 mi ation of one candidate ation in groups (groups (approx. 8 pages)	nutes) or each (approx. 10 minu of 2, approx. 10 minu	ites) or tes per candidate) oi		
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
This m	ndule i	designed for students	studving at least one	subject in the natura	lsciences	
Worklo	ad					
WOIKIO	au					
60 h			_			
Teachi	ng cycl	e	_			
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
§ 22 § 22 § 22	Nr. 1 h) Nr. 2 f) Nr. 3 f)					
Module	e appea	irs in				
First sta First sta First sta First sta First sta First sta	ate exa ate exa ate exa ate exa ate exa ate exa ate exa	mination for the teachin mination for the teachin	g degree Grundschule g degree Grundschule g degree Realschule F g degree Gymnasium g degree Sonderpäda g degree Mittelschule g degree Mittelschule	Physics (2015) Didactics in Physics Physics (2015) Physics (2015) gogik Didactics in Ph Physics (2015) Didactics in Physics	s (Primary School) (2 nysics (Middle Schoo s (Middle School) (20	.015) DI) (2015) D15)
FIRST Sta LA Mittelso	ate exa	mination for the teachin	Ig aegree Grundschule IMU Würzburg • g	enerated 10-Apr-2025 • exam	. reg. data re-	page 26 / 58
L'imitieist	nateri rity	5105 (2020)	cord Lehramt Mit	telschulen (Unterrichtsfach) F	Physik - 2020	puge 20 / 50

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) First state examination for the teaching degree Grundschule Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Grundschule Physics (2020) First state examination for the teaching degree Grundschule Physics (2020) First state examination for the teaching degree Realschule Physics (2020) First state examination for the teaching degree Realschule Physics (2020) First state examination for the teaching degree Realschule Physics (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) First state examination for the teaching degree Mittelschule 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 Didactics in Physics (Middle School) (2020)

cord Lebramt Mittelschulen (Unterrichtsfach) Physik - 2020	LA Mittelschulen Physics (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data re-	page 27 / 58
		cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Modul	Module title Abbreviation					
Studer	Student Lab Preparation Course (Physics) 11-L-L3S-152-m01					
Modul	e coord	inator		Module offered by		
holder	of the C	hair of Physics and its	Didactics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	numer	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conter	nts		_•			
The mo can be thods a	odule gi perforn are emp	ves an overview of app ned in teaching-learnin loyed.	icable physical experi g-laboratories (M!ND c	ments that provide a enter). In these expe	n introduction to sci riments, different wo	ence and orking me-
Intend	ed learr	ning outcomes				
The stuve gair subjec to holo and to pupils	The students know how to prepare and follow-up a visit in a teaching-learning-laboratory (M!ND-Center) and have gained an overview of current didactic research topics and further possibilities for development in the field of subject-didactic research. They are able to evaluate and assess the (affective) learning achievements of pupils, to hold scientific-propaedeutic classes, to positively influence the motivation of pupils in the subject of Physics and to raise their interest for current physical research questions. The students are able to select, set up or build pupils experiments in a target-oriented manner, and to supervise pupils while experimenting.					
S (5)						
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) writi b) oral c) oral d) term e) port Langua	 a) written examination (approx. 45 minutes) or b) oral examination of one candidate each (approx. 10 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) or d) term paper (approx. 8 pages) or e) portfolio (10 to 15 hours total) Language of assessment: German and/or English 					
Additional information						
Workload						
150 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
§ 53 Nr. 2						
Module appears in						
First state examination for the teaching degree Grundschule Physics (2015)						
First state examination for the teaching degree Realschule Physics (2015)						
First state examination for the teaching degree Mittelschule Physics (2015)						
First state examination for the teaching degree Grundschule Physics (2018)						
First state examination for the teaching degree Realschule Physics (2018)						
First state examination for the teaching degree Mittelschule Physics (2018)						
First st	ate exa	mination for the teachir	ng degree Grundschule	e Physics (2020)		
First st	ate exa	mination for the teaching	ng degree Realschule F	Physics (2020)		
LA Mittelso	chulen Phys	sics (2020)	JMU Würzburg • g	enerated 19-Apr-2025 • exam	. reg. data re- Physik - 2020	page 28 / 58



First state examination for the teaching degree Mittelschule Physics (2020)

LA Mittelschulen Physics (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data re-	page 29 / 58
	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Module title					Abbreviation	
Moder	n Physi	CS 1			11-L-M1-NV-172-mo	1
Modul	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of A	pplied 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	undergraduate				
Conten	Its		•			
 Structure Structure Quarature Quarature Quarature The fill of the study The fill of the study Atom effect Fine Steir ter), dyna Multure Multure Steir ter), dyna Multure Multure<td>cture of atom, is ntum m aves, w ntizatio tic Schr non-rela- noment ntum nu ns in ex ct, elect and hy n-de Ha electro amics), ielectro y with n wave fin ents, A t-matte ct, collis ER: elem st, collis ER: el</td><td>atoms: experimental ev otopes, internal structure echanical foundations of vave functions and proba- n in the atom, Franck-He ödinger equation. ativistic hydrogen atom: um in QM, Schrödinger e- umbers, energy eigenvalu- ternal fields: orbital mag- rical fields: orbital mag- rical fields: Stark effect. perfine structure: electro as effect, glimpse of the n spin resonance (ESR), nuclear spin and hyperfi- on atoms: helium atom a respect to particle excha- unction of two-particle sy- ufbau principles and Hu r interaction: time-deper ents and dipole approxi- sion broadening), atomic nentary optical processe amplification, Einstein's ons, population inversion lasers, examples (ruby la- excitations and x-ray phy m, x-ray emission for ele ay photoemission, non-ra- ind chemical bonding: m LCAO approach, bondin leitler-London approxima- onds and Lennard-Jones- tations and vibrations: E ules), centrifugal splittin- nal modes, vibrational-ra- pectroscopy: transition r vibrational-rotational tra- nets and measuring me- and the relevant experim wledge and to integrate</td><td>idence for the existen re, Rutherford experin of atomic physics (sho ability interpretation, rtz experiment, atomi hydrogen and hydrog equation of the H-ator ues. gnetic dipole moment onic spin and magneti Dirac equation (spin spin-orbit coupling, re ne structure. s simplest example, i nge, fermions and bo ystems (spin singlets nd's rules. ndent perturbation the mation, selection rule c spectroscopy. s (absorption, sponta rate equations, therm n, and laser condition aser, He-Ne laser, sen ysics: generation of x- emental analysis (EDX adiative Auger process nolecular hydrogen io g and antibonding mo ation, biatomic hetero s potential, (time allow Born-Oppenheimer ap ng/expansion, molecu- rotational interaction. matrix elements, vibra ansitions: Fortrat diag</td><td>ice of atoms, size of nent, instability of th ort recap of part A.): I uncertainty relation a c spectra, Bohr's mo gen-like atoms, centr n, atomic orbitals, ra , gyromagnetic ratio, c spin moment, Ster as relativistic pheno elativistic fine structu ndistinguishability o sons, relationship to and triplets), LS- and eory (Fermi's Golden es and symmetry, line aneous and stimulate nal equilibrium, non- , principle structure niconductor laser). ray radiation, Brems), x-ray absorption a ses, synchrotron rad n (H2+) as simplest e olecular orbitals, hyco proximation, rigid ro ational spectroscopy ram, electronic trans of quantum phenom nd know the structure nd the ideas and co neasure quantum phe</td><td>the atom, charges a e "classical" Rutherf ight as particle beam and stability of the a idel and its limitatio al-symmetric potent idial and angular wa magentic fields: no n-Gerlach experiment menon and existence ure, Lamb shift (qua of identical particles, spin, Pauli principle d jj-coupling, period Rule) and optical tra e broadening (lifetim ed emission), stimul equilibrium characte of a laser, optical pu strahlung and chara nd contrast formatio liation, application e example: rigid molec frogen molecule (H2 covalent vs. ionic bo lecules). otator (symmetric an oscillator, Morse pot : infrared spectrosco sitions: Franck-Cond ena as well as Atom re and application o ncepts of quantum t nenomena. They are</td><td>nd masses in ford atom n, particles tom, energy ns, non-rela- ial and angu- ve functions, rmal Zeeman nt, Ein- ie of antimat- ntum electro- (anti)sym- e, orbital and ic table of the ansitions, ne, Doppler ated emissi- er of a laser: imping, 2-, 3- icteri- on in x-ray examples. cule approxi-): molecular onding, van d unsymme- iential, nor- opy and Ra- on principle.</td>	cture of atom, is ntum m aves, w ntizatio tic Schr non-rela- noment ntum nu ns in ex ct, elect and hy n-de Ha electro amics), ielectro y with n wave fin ents, A t-matte ct, collis ER: elem st, collis ER: el	atoms: experimental ev otopes, internal structure echanical foundations of vave functions and proba- n in the atom, Franck-He ödinger equation. ativistic hydrogen atom: um in QM, Schrödinger e- umbers, energy eigenvalu- ternal fields: orbital mag- rical fields: orbital mag- rical fields: Stark effect. perfine structure: electro as effect, glimpse of the n spin resonance (ESR), nuclear spin and hyperfi- on atoms: helium atom a respect to particle excha- unction of two-particle sy- ufbau principles and Hu r interaction: time-deper ents and dipole approxi- sion broadening), atomic nentary optical processe amplification, Einstein's ons, population inversion lasers, examples (ruby la- excitations and x-ray phy m, x-ray emission for ele ay photoemission, non-ra- ind chemical bonding: m LCAO approach, bondin leitler-London approxima- onds and Lennard-Jones- tations and vibrations: E ules), centrifugal splittin- nal modes, vibrational-ra- pectroscopy: transition r vibrational-rotational tra- nets and measuring me- and the relevant experim wledge and to integrate	idence for the existen re, Rutherford experin of atomic physics (sho ability interpretation, rtz experiment, atomi hydrogen and hydrog equation of the H-ator ues. gnetic dipole moment onic spin and magneti Dirac equation (spin spin-orbit coupling, re ne structure. s simplest example, i nge, fermions and bo ystems (spin singlets nd's rules. ndent perturbation the mation, selection rule c spectroscopy. s (absorption, sponta rate equations, therm n, and laser condition aser, He-Ne laser, sen ysics: generation of x- emental analysis (EDX adiative Auger process nolecular hydrogen io g and antibonding mo ation, biatomic hetero s potential, (time allow Born-Oppenheimer ap ng/expansion, molecu- rotational interaction. matrix elements, vibra ansitions: Fortrat diag	ice of atoms, size of nent, instability of th ort recap of part A.): I uncertainty relation a c spectra, Bohr's mo gen-like atoms, centr n, atomic orbitals, ra , gyromagnetic ratio, c spin moment, Ster as relativistic pheno elativistic fine structu ndistinguishability o sons, relationship to and triplets), LS- and eory (Fermi's Golden es and symmetry, line aneous and stimulate nal equilibrium, non- , principle structure niconductor laser). ray radiation, Brems), x-ray absorption a ses, synchrotron rad n (H2+) as simplest e olecular orbitals, hyco proximation, rigid ro ational spectroscopy ram, electronic trans of quantum phenom nd know the structure nd the ideas and co neasure quantum phe	the atom, charges a e "classical" Rutherf ight as particle beam and stability of the a idel and its limitatio al-symmetric potent idial and angular wa magentic fields: no n-Gerlach experiment menon and existence ure, Lamb shift (qua of identical particles, spin, Pauli principle d jj-coupling, period Rule) and optical tra e broadening (lifetim ed emission), stimul equilibrium characte of a laser, optical pu strahlung and chara nd contrast formatio liation, application e example: rigid molec frogen molecule (H2 covalent vs. ionic bo lecules). otator (symmetric an oscillator, Morse pot : infrared spectrosco sitions: Franck-Cond ena as well as Atom re and application o ncepts of quantum t nenomena. They are	nd masses in ford atom n, particles tom, energy ns, non-rela- ial and angu- ve functions, rmal Zeeman nt, Ein- ie of antimat- ntum electro- (anti)sym- e, orbital and ic table of the ansitions, ne, Doppler ated emissi- er of a laser: imping, 2-, 3- icteri- on in x-ray examples. cule approxi-): molecular onding, van d unsymme- iential, nor- opy and Ra- on principle.
	hulen Dhu	sics (2020)	MU Würzburg • g	enerated 10-Apr-2025 • exam	reg data re-	nage 20 / 58
LA MILLEISC	muteri Phy	5165 (2020)	cord Lehramt Mit	telschulen (Unterrichtsfach) F	hysik - 2020	page 30 / 58

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

V (3) + Ü (2)

Module taught in: German or English

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

written examination (approx. 120 minutes)

Language of assessment: German and/or English

Allocation of places

--

Additional information

--

Workload

180 h

Teaching cycle

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

§ 53 | Nr. 1 b)

Module appears in

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

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

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

First state examination for the teaching degree Grundschule Physics (2020)

First state examination for the teaching degree Realschule Physics (2020)

First state examination for the teaching degree Mittelschule Physics (2020)

_A	Mitte	lschu	len	Physics	(2020)	

Module title				Abbreviation			
Moder	Modern Physics 2 11-L-M2-NV-172-m01						
Module coordinator				Module offered by			
Managing Director of the Institute of Ap			plied Physics	Faculty of Physics a	nd Astronomy		
ECTS	Meth	od of grading	Only after succ. con	pl. of module(s)			
5	nume	rical grade					
Durati	on	Module level	Other prerequisites				
2 sem	ester	undergraduate					
Conte	nts						
Germa	n conte	nts available but not tran	slated yet.				
Mecha tronisc gen, Tl	anische, che Anre hermisc	, dielektrische und magne egung von Molekülen, Me he Eigenschaften von Iso	etische Eigenschafter essmethoden, Strukti latoren.	n von Molekülen, Rot ur von Festkörpern, S	tations-,Schwingungs- und elek- Streumethoden, Gitterschwingun-		
Intend	ed lear	ning outcomes					
Germa	n inten	ded learning outcomes av	vailable but not trans	lated yet.			
Verstä den zu transla	ndnis d Ir Unter ationsin	es Aufbaus von Moleküle suchung von Molekülen, variantes Gitter und der H	en und der chemische Verständnis des Auft Konsequenzen.	en Bindung, Verstän baus kristalliner Fest	dnis der experimentellen Metho- körper, ihrer Modellierung als		
Course	es (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)		
V (4) + Modul	Ü (1) e taugh	t in: Ü: German or Englisł	1				
Metho ster, ir	d of as 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) writ b) oral Langua	ten exa examir age of a	mination (approx. 90 to 1 nation of one candidate e ssessment: German and	20 minutes) or ach (approx. 20 minu ⁄or English	utes)			
Alloca	tion of I	olaces					
Additi	onal inf	ormation					
Workle	hen						
150 h							
Peferred to in LPO L (examination regulations for teaching degree programmes)							
953 NI. 1 D)							
Modul	e appea	ars in					
First st	First state examination for the teaching degree Grundschule Physics (2018)						
First St	First state examination for the teaching degree Realschule Physics (2018)						
First St	tate evo	mination for the teaching	degree Grundschuld	Physics (2018)			
Firct ct	ate exa	mination for the teaching	, degree Realschule P	Physics (2020)			
First st	tate exa	mination for the teaching	degree Mittelschule	Physics (2020)			

Module title					Abbreviation		
Optics	Optics and Waves 11-L-OW-172-mo1						
Module	e coord	inator		Module offered by			
Manag	ing Dire	ector of the Institute of	Applied Physics	pplied Physics Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. cor	npl. of module(s)			
7	nume	rical grade					
Duratio	on	Module level	Other prerequisites	i			
1 seme	ster	undergraduate	Admission prerequi	site to assessment:	completion of exerci	ses (approx.	
			13 exercise sheets p	oer semester). Stude	nts who successfully	completed	
			approx. 50% of exe	rcises will qualify for	admission to assess	sment. The	
			lecturer will inform	students about the r	espective details at t	he beginning	
			of the semester.				
Conten	Its						
1. Light	t: (linke	ed to 11-E-E): Basic con	cepts, the speed of ligh	nt, Huygens-Fresnel p	orinciple, reflection,	refraction;	
2. Light	t in mat	ter: Propagation veloc	ity in the medium; disp	ersion, complex and	frequency-depende	nt dielectric	
cons	tant; a	bsorption, Kramers-Kro	onig relation, interfaces	, Fresnel equations,	polarisation, genera	tion by ab-	
Sorp	tion, di notrica	rennigence, optical ac	tivity (dipole); s Fermat's principle o	ntical nath Gaussia	n ontice reflection r	ofraction	
plan	e interf	aces. Snell's law. total	reflection. optical tunr	eling, evanescent w	aves, prism: normal	and anoma-	
lous	disper	sion, curved interfaces	, thin and thick lenses,	lens systems, lens g	rinder formula, aber	rations, ima-	
ging	errors	(spherical & chromatic	aberration, astigmatis	m, coma, distortion,	correction approach	es);	
4. Opti	cal inst	ruments: Characteristi	cs, camera, eye, magni	fying glass, microsco	ppe, telescope types	, bundle be-	
am v	s. Imag	e construction (electro	on lenses, electron mici	roscope), confocal m t Voung's experimen	icroscopy; t_interference_patte	rn (intonci-	
tv pr	ofile), t	hin lavers, parallel lav	ers, wedge-shaped lave	ers, phase shift. New	ton rings, interferom	eter (Michel-	
son,	Mach-2	Zender, Fabry-Perot);		, p			
6. Diffr	action i	n the far field: Fraunho	ofer diffraction, single s	lit, intensity distribu	tion, apertures, reso	lving power:	
Rayle	eigh & /	Abbé criterion, Fourier	optics, optical grating,	n-fold slit, intensity	distribution, grating	spectrometer	
and	resolut	ion, diffraction off ator	nic lattices, convolution	n theorem; diffraction at circula	raporturos/dicks E	rochal zana	
plate	e. near-	field microscopy, holo	graphy, Huygens-Fresh	el concept: white ligh	nt hologram:		
8. Failu	re of cl	assical physics I - from	light wave to photon:	Black body radiation	and Planck's quant	um hypothe-	
sis;	photoe	lectric effect and Einste	ein's explanation, Com	pton effect, light as a	n particle, wave-parti	cle duality,	
quar	ntum st	ructure of nature;					
9. Failu	ire of cl	assical physics II - par	ticles as waves: De Bro	glie's matter wave co	oncept; diffraction of	particle wa-	
10Wav	Daviss e mech	anics: Wave nackets in	hase and group veloci	ty (recap of 11-FM) u	ncertainty principle	Nv-	
quis	t-Shanı	ion theorem, wave fun	ction as probability am	plitude, probability	of residence, measu	rement pro-	
cess	in qua	ntum mechanics (dou	ole-slit experiment & wl	nich-way information	, collapse of the way	ve function,	
Schr	ödinge	r's cat);					
11.Math	iematic	al concepts of quantu	m mechanics: Schrödir	iger equation as wav	e equation, concept	ual compari-	
valu	e equat	ion simple examples	in 1D (notential sten in	otential barrier and t	unnel effect hox not	ential and	
ener	gy quai	ntisation, harmonic os	cillator), box potential i	n higher dimensions	and degeneracy, fo	rmal theory	
of QM (states, operators, observables).							
Intend	ed lear	ning outcomes					
The stu	dents	understand the basic p	orinciples and contexts	of radiation, wave a	nd quantum optics a	nd quantum	
phenor	mena a	s well as Atomic and N	Iolecular Physics. They	understand the theo	retical concepts and	l know the	
structu	structure and application of important optical instruments and measuring methods. They understand the ideas						
and co	ncepts	na They are able to di	scuss their knowledge	relevant experiments	s to observe and mea	asure quan-	
LA Mittelsc	hulen Phy	sics (2020)	JMU Würzburg ● g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	n. reg. data re- Physik - 2020	page 33 / 58	

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

V (4) + Ü (2)

Module taught in: Ü: German or English

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

written examination (approx. 120 minutes)

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

Allocation of places

Additional information

--

Workload

210 h

Teaching cycle

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

§ 53 l Nr. 1 a)

§ 77 | Nr. 1 a)

Module appears in

First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Realschule Physics (2018) First state examination for the teaching degree Gymnasium Physics (2018) First state examination for the teaching degree Mittelschule Physics (2018) 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 Realschule Physics (2020) First state examination for the teaching degree Mittelschule Physics (2020)

LA Mittelschulen Physics (2020)	
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Module	e title			Module title Abbreviation					
Physic	Physics Teaching Concepts 11-L-PD-172-mo1								
Module	e coord	inator		Module offered by	· · · · · · · · · · · · · · · · · · ·				
holder	of the C	Chair of Physics and its	Didactics	Faculty of Physics a	nd Astronomy				
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)					
5	nume	rical grade							
Duratio	on	Module level	Other prerequisites	Other prerequisites					
2 seme	ester	undergraduate							
Conten	its		_						
of the o subject sics co typical these; the sci	ng of ba degree t; comp ntent; r learnin dealing ence of ed learr	asic concepts of physics programme. Justification etence models and edu nethods and media in p g difficulties in the subj with student perceptio physics, including histo ing outcomes	education and didac n/legitimation of phys loational standards; e hysics lessons and th lect areas of physics ro ns; teaching approach prical development;	tic consolidation of s ics teaching; educat lementarisation and eir use to promote le elevant to teaching a nes to the structure a	subject-relevant scie ional objectives of p didactic reconstruct earning; student pero nd teaching concep and cognitive/workin	ntific content hysics as a ion of phy- ceptions and ts based on ig methods of			
Studer	its are f	amiliar with central phy	sics teaching concept	s to design target gro	oun-orientated physi	ics lessons.			
They cl familia critical	early di r with s ly discu	fferentiate didactic asp ubject-specific student ss specific teaching co	ects of physics lesson conceptions and their ncepts against this ba	s from scientific and r significance for the ckground.	educational aspects students' learning p	s. They are rocess. They			
Course	s (type	number of weekly cont	act hours, language –	- if other than Germa	n)				
V (2) +	V (2) +	Ü (1)							
Metho ster, in a) writt	d of ass formati	essment (type, scope, l on on whether module nination (approx, 60 mi	anguage — if other th can be chosen to earn inutes) or	an German, examina a bonus)	tion offered — if not	every seme-			
b) oral c) oral d) term Langua	examin examin paper age of a	ation of one candidate ation in groups (groups (approx. 8 pages) ssessment: German and	each (approx. 15 minu of 2, approx. 15 minu d/or English	ites) or tes per candidate) or					
Allocat	ion of r	laces							
			_						
Additic	nal inf	ormation	_						
Auditic									
Warkla									
workie	au		_						
150 n			-						
Referred to in LPO I (examination regulations for teaching-degree programmes)									
§ 36 N	۱r. 7								
§ 53 Nr. 2									
§ 77 Nr. 2									
Module appears in									
First st	ate exa	mination for the teachir	ng degree Grundschule	e Physics (2018)					
First st	First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2018)								
First st	ate exa	mination for the teachir	ng degree Realschule I	Physics (2018)					
First st	ate exa	mination for the teachir	ng degree Gymnasium	Physics (2018)					
LA Mittelso	hulen Phy	sics (2020)	JMU Würzburg • g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	. reg. data re- Physik - 2020	page 35 / 58			

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) 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 Realschule Physics (2020) First state examination for the teaching degree Mittelschule 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 Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2020)

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Module title				Abbreviation	
Physics Teaching Concepts Seminar 11-L-PDS-NV-152-mo1					
Module coordinator			Module offered by		
holder of the Chair of Physics an	d its Didact	tics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading	Onl	y after succ. com	pl. of module(s)		
2 (not) successfully comp	leted				
Duration Module level	Oth	er prerequisites			
1 semester undergraduate					
Contents					
Different topics of current subject education, evaluation, task cult media and their application for l methods, new teaching method	ct-didactic r ure, interdis earning sup s.	research; examp sciplinary classes oport, especially	les: Interest and phy s, language in physic regarding computer	sics education, girls in physics cs education, effects of subject s, epistemological and working	
Intended learning outcomes					
Knowledge of selected methods knowledge of didactic physical l and to discuss different prioritis	of didactic iterature. A ations and	physical researc bility to critically approaches.	h, evaluation of dida evaluate Physics cla	actic physical research projects, asses in view of different aspects	
Courses (type, number of weekly	/ contact ho	ours, language —	if other than Germa	n)	
S (2)					
Method of assessment (type, scope, language — if other than German, examination offered — if not every seme- ster, information on whether module can be chosen to earn a bonus) a) written examination (approx. 45 minutes) or b) oral examination of one candidate each (approx. 10 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) or d) term paper (approx. 8 pages)					
Allocation of places					
Additional information					
Workload					
60 h					
Teaching cycle					
Referred to in LPO I (examination	on regulatio	ns for teaching-c	legree programmes)		
\$ 53 Nr. 2					
Module appears in					
First state examination for the te	aching deg	ree Grundschule	Physics (2015)		
First state examination for the teaching degree Realschule Physics (2015)					
First state examination for the te	aching deg	ree Mittelschule	Physics (2015) Physics (2018)		
First state examination for the te	aching deg	ree Realschule P	hvsics (2018)		
First state examination for the te	aching deg	ree Mittelschule	Physics (2018)		
First state examination for the te	aching deg	ree Grundschule	Physics (2020)		
First state examination for the te	aching deg	gree Realschule P	hysics (2020)		
First state examination for the te	aching deg	ree Mittelschule	Physics (2020)		

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Module title				Abbreviation		
Physics: Practi	cal Training and Theory	of Classroom		11-L-SBPMS-152-mo1		
Module coordi	nator		Module offered by			
holder of the C	hair of Physics and its D	idactics	Faculty of Physics a	nd Astronomy		
ECTS Metho	d of grading	Only after succ. com	pl. of module(s)			
4 (not) sı	uccessfully completed					
Duration	Module level	Other prerequisites				
1 semester	undergraduate					
Contents						
The module int cal practice of I holding classes sed in agreeme lyse classes; bi sequences and transparency si dents in develo	The module introduces teaching practice. The students gain insights into the pedagogical, didactic and methodi- cal practice of Physics by observing and discussing classes. They consolidate their knowledge by preparing and holding classes themselves. In the corresponding seminar, the following topics (among others) will be discus- sed in agreement with the teachers: Introduction to the curriculum of Hauptschule; criteria to observe and ana- lyse classes; basics of general school and class pedagogics; subject-specific work methods; planning of class sequences and models; introduction to the usage of modern media; development of blackboard pictures and transparency sketches. The main focus will be on class practice, the corresponding seminar also helps the stu-					
Intended learn	ing outcomes					
The students h are able to imp lect and use mo school pedago the organisatio	ave gained deep insight lement the contents of t edia, methods and socia gics and learning psycho n of classes.	s into the main steps he curricula for differ al forms according to ology with subject-dio	of planning, prepar ent grades in a pract learning goals; they dactic knowledge an	ing and organising classes; they tical manner; they are able to se- are able to connect findings of d to integrate these findings into		
Courses (type,	number of weekly conta	ct hours, language —	if other than Germa	n)		
P (0) + S (2)						
Method of assester, informatic	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-		
term paper (15 Language of as	to 20 pages) sessment: German and,	/or English				
Allocation of p	laces					
Additional info	rmation					
Workload						
120 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
§ 34 1 Nr. 4						
Module appears in						
First state exan First state exan on 2015))	nination for the teaching nination for the teaching	g degree Mittelschule g degree Mittelschule	Educational Science Educational Science	e (2015) e (2020 (Prüfungsordnungsversi-		

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	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

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Module title Abbreviation						
Scienti	Scientific Work in Teaching Concepts 11-L-WPD-152-mo1					
Module coordinator				Module offered by		
Manag	naging Director of the Institute of Applied Physics		Applied Physics	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
3	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Current	topics	in scientific work in phy	ysics education			
Intend	ed lear	ning outcomes				
The stu	donte	have knowledge of a cu	rrent subdiscipline of	hysics education ar	d are able to proces	s questions
of phys	ics edu	ication on the basis of s	cientific methods.	Shysics education at	id are able to proces	ss questions
Course	s (type	, number of weekly cont	act hours, language –	- if other than Germa	n)	
S (2)						
Module	e taugh	t in: German or English				
Metho ster, in	d of ass formati	sessment (type, scope, l on on whether module	anguage — if other the can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
talk (30	o to 45	minutes)				
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Auunto	ilat illi					
 Worklo	ad					
oo h	oo b					
Teachi	ng cycl	e				
	.5 .,	•				
Referre	d to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
§ 22	Nr. 1 h)					
§ 22	Nr. 2 f)					
§ 22	Nr. 3 f)					
Module	e appea	ars in				
First sta	ate exa	mination for the teachir	ng degree Grundschule	Physics (2015)		
First sta	ate exa	mination for the teachir	ng degree Grundschule	e Didactics in Physics	s (Primary School) (2	.015)
First sta	ate exa	mination for the teachir	ng degree Realschule F	Physics (2015)		
First sta	ate exa	mination for the teachir	ng degree Gymnasium	Physics (2015)		
First sta	ate exa	mination for the teachir	ng degree Sonderpäda	gogik Didactics in Ph	nysics (Middle Schoo	ol) (2015)
First sta	ate exa	mination for the teachir	ig degree Mittelschule	Physics (2015)		
First sta	ate exa	mination for the teachir	ng degree Mittelschule	Didactics in Physics	(Middle School) (20	015)
First sta	ate exa	mination for the teachir	ng degree Grundschule	e Physics (2018)		
First sta	ate exa	mination for the teachir	ig degree Grundschule	e Didactics in Physics	s (Primary School) (2	.018)
First sta	ate exa	mination for the teachir	ng degree Realschule F	Physics (2018)		
First sta	ate exa	mination for the teachir	ng degree Gymnasium	Physics (2018)		
First sta	ate exa	mination for the teachir	ig degree Mittelschule	Physics (2018)	. /	
First sta	ate exa	mination for the teachir	ig degree Sonderpäda	gogik Didactics in Ph	nysics (Middle Schoo	ol) (2018)
First sta	ate exa	mination for the teachir	ig degree Mittelschule	Didactics in Physics	(Middle School) (20	018)
First sta	ate exa	mination for the teachir	ig degree Grundschule	e Didactics in Physics	6 (Primary School) (2	.020)
LA Mittelsc	hulen Phy	sics (2020)	JMU Würzburg ● g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	. reg. data re- Physik - 2020	page 39 / 58

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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)

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Module title Abbreviation				Abbreviation			
Current Topics in Physics			11-LX6-152-m01				
Module coordinator				Module offered by			
chairperson of examination committee		ee	Faculty of Physics a	nd Astronomy			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade	al grade				
Durati	on	Module level	Other prerequisites				
1 semester undergraduate Approval from examination committee required.							
Conter	nts						
Curren	t topics	in physics.					
Intend	ed leari	ning outcomes					
The stu lation know t	udents l method he appl	nave knowledge of a cu s necessary to acquire ication areas.	urrent subdiscipline of I this knowledge. They a	Physics and understance and understance able to classify the second second second second second second second s	and the measuring a le subject-specific co	nd/or calcu- ontexts and	
Course	es (type	, number of weekly cor	ntact hours, language –	- if other than Germa	n)		
V (3) +	R (1)						
Metho ster, in	d of ass Iformati	s essment (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-	
 b) oral c) oral d) proj e) pres lf a wri stead to of asse nation Langua 	 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. 						
Allocat	tion of r	blaces					
	<u></u>						
Additio	onal inf	ormation					
Worklo	oad						
180 h							
Teachi	ng cycl	e					
Referre	ed to in	LPO I (examination re	gulations for teaching-	degree programmes)			
§ 22 § 22 § 22	Nr. 1 h) Nr. 2 f) Nr. 3 f)						
Modul	e appea	ars in					
First st First st First st First st First st First st	ate exa ate exa ate exa ate exa ate exa ate exa	mination for the teach mination for the teach	ing degree Grundschule ing degree Grundschule ing degree Realschule F ing degree Gymnasium ing degree Sonderpäda ing degree Mittelschule	Physics (2015) Didactics in Physics Physics (2015) Physics (2015) gogik Didactics in Physics (2015) Didactics in Physics	s (Primary School) (2 nysics (Middle School) (2	:015) DI) (2015)	
LA Mittelso	chulen Phy	sics (2020)	JMU Würzburg • g	enerated 19-Apr-2025 • exam	. reg. data re-	page 41 / 58	
			cord Lehramt Mit	telschulen (Unterrichtsfach) F	hysik - 2020		

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Low Cost - High Impact. Low-budget Experiments for Science Courses (Phy- sics) 11-MIND-Ph1-152-m01 Module coordinator Module offered by Module offered by holder of the Chair of Physics and its Didactics Faculty of Physics and Astronomy ECTS Met→d of grading Only after succ. compl. of module(s) 2 (not) successfully completed Duration Module level Other prerequisites 1 semester undergraduate 1 semester undergraduate Conception and realisation of experimental stations with ordinary and inexpensive consumables for classes of Grundschule and secondary level I. Intended learning outcomes				
sics) Module coordinator Module offered by holder of the Chair of Physics and its Didactics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) 2 (not) successfully completed Duration Module level Other prerequisites 1 semester undergraduate Contents Successful realisation of experimental stations with ordinary and inexpensive consumables for classes of Grundschule and secondary level I. Intended learning outcomes Successful realisation of experimental stations with ordinary and inexpensive consumables for classes of Grundschule and secondary level I.				
Module cordinator Module offered by holder of tree by sics and its D by sics and its D by sics and Astronomy Faculty of Physics and Astronomy ECTS Method of grading Only after succ. combule(s) 2 (not) > uccessfully completed Durationationationationationationationation				
Faculty of Physics and its Didactics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) 2 (not) successfully completed Duration Module level Other prerequisites 1 semester undergraduate Contents Successfully completed Conception and realisation of experimental stations with ordinary and inexpensive consumables for classes of Grundschule and secondary level I. Intende learning outcomes				
ECTS Meth→ of grading Only after succ. compl. of module(s) 2 (not) successfully completed Duration Module level Other prerequisites 1 semester undergraduate Contents Conception and realisation of experimental stations with ordinary and inexpensive consumables for classes of Grundschule and secondary level I. Intended learing outcomes Module learing outcomes				
2 (not) successfully completed Duration Module level Other prerequisites 1 semester undergraduate Contents Conception and realisation of experimental stations with ordinary and inexpensive consumables for classes of Grundschule and secondary level I. Intended learning outcomes				
Duration Module level Other prerequisites 1 semester undergraduate Contents Conception and realisation of experimental stations with ordinary and inexpensive consumables for classes of Grundschule and secondary level I. Intended learning outcomes				
1 semester undergraduate Contents Conception and realisation of experimental stations with ordinary and inexpensive consumables for classes of Grundschule and secondary level I. Intended learning outcomes				
Contents Conception and realisation of experimental stations with ordinary and inexpensive consumables for classes of Grundschule and secondary level I. Intended learning outcomes				
Conception and realisation of experimental stations with ordinary and inexpensive consumables for classes of Grundschule and secondary level I.				
Intended learning outcomes				
The students develop simple scientific experimenting stations to use for the transition from primary to secondary level I for small groups from different types of schools. In doing so, they learn to simplify and convey scientif contents relevant to the curriculum in due consideration of the target group.				
Courses (type, number of weekly contact hours, language — if other than German)				
S (2)				
Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus)				
a) written examination (approx. 45 minutes) or b) oral examination of one candidate each (approx. 10 minutes) or c) oral examination in groups (groups of 2, approx. 20 minutes) or d) term paper (approx. 8 pages)				
Allocation of places				
Additional information				
This module is designed for students studying at least one subject in the natural sciences.				
Workload				
60 h				
Teaching cycle				
Referred to in LPO L (examination regulations for teaching degree programmes)				
§ 22 Nr. 2 f) § 22 Nr. 3 f)				
Module appears in				
Module appears in 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 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 Grundschule Physics (2018) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Grundschule Physics (2018)				
First state examination for the teaching degree Gymnasium Physics (2018) LA Mittelschulen Physics (2020) JMU Würzburg • generated 19-Apr-2025 • exam. reg. data re- page 43 / 58				

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) 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 Realschule Physics (2020) First state examination for the teaching degree Mittelschule 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 Didactics in Physics (Middle School) (2020) First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2020)

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Module	Module title Abbreviation						
Teaching Science with Hands-on-Exhibits (Physics)			11-MIND-Ph2-152-m	01			
Module coordinator			Module offered by				
holder	older of the Chair of Physics and its Didactics		Faculty of Physics a	nd Astronomy			
ECTS	Metho	od of grading	Only after succ. compl. of module(s)				
2	(not) s	successfully completed	completed				
Duration Module level Other prerequisites							
1 seme	ster	undergraduate					
Conten	its						
Design	Designing and creating hands-on exhibits for STEM subjects.						
Intend	ed lear	ning outcomes					
The stu tents in ject-ori	idents on and o ented v	evaluate the advantage ut of school. They plan vork with pupils of seco number of weekly con	s and disadvantages o and implement an inte ondary level I and II. tact hours language –	of the hands-on appro rdisciplinary science	oach for teaching sci e exhibition as an ex	ientific con- ample of pro-	
S(a)				in other than defina			
3 (2)			:f a the set the		tion offered if not		
ster, in	d of ass formati	on on whether module	can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-	
a) writt b) oral c) oral d) term	en exai examir examin paper	mination (approx. 45 m ation of one candidate ation in groups (groups (approx. 8 pages)	inutes) or each (approx. 10 minu 5 of 2, approx. 20 minu	ites) or tes) or			
Allocat	ion of p	olaces					
Additio	onal inf	ormation					
This module is designed for students studying at least one subject in the natural sciences.							
Worklo	Workload						
60 h			-				
Teachi	ng cycl	e					
Referre	ed to in	LPOI (examination res	gulations for teaching-	degree programmes)			
§ 22 § 22 § 22	Nr. 1 h) Nr. 2 f) Nr. 3 f)						
Modul	e appea	ars in					
First st	ate exa	mination for the teachi	ng degree Grundschule	Physics (2015)			
First st	ate exa	mination for the teachi	ng degree Grundschule	e Didactics in Physics	s (Primary School) (2	015)	
First st	ate exa	mination for the teachi	ng degree Realschule F	Physics (2015)			
First st	ate exa	mination for the teachi	ng degree Gymnasium	Physics (2015)			
First st	ate exa	mination for the teachi	ng degree Sonderpäda	gogik Didactics in Ph	nysics (Middle Schoo	ol) (2015)	
First st	ate exa	mination for the teachi	ng degree Mittelschule	Physics (2015)		``	
First st	ate exa	mination for the teachi	ng degree Mittelschule	Didactics in Physics	s (Miadle School) (20	015)	
FIRST ST	ate exa	mination for the teachi	ng degree Grundschule	e MIYSICS (2018) Didactics in Dhusie	(Drimany School) (a	018)	
First St	ate exa	mination for the teach	ng degree GrundSchule ng degree Realechule E	Physics (2018)	5 (FIIIIary School) (2	010)	
First st	ate exa	mination for the teachi	ng degree Gymnacium	Physics (2010)			
First st	ate exa	mination for the teachi	ng degree Mittelschule	Physics (2018)			
				.,			
LA Mittelsc	hulen Phy	SICS (2020)	JMU Würzburg • g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	i. reg. data re- Physik - 2020	page 45 / 58	

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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) 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 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)

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Module title				Abbreviation		
Mathematical Methods of Physics				11-M-MR-202-m01		
Module coordinator			Module offered by			
Managing Director of the Institute of Theo and Astrophysics		heoretical Physics	Faculty of Physics and Astronomy			
ECTS Method of grading Only after succ.			npl. of module(s)			
6 (not)	successfully completed					
Duration	Module level	Other prerequisites				
2 semester	undergraduate					
Contents	Contents					
German conte	ents available but not tra	anslated yet.				
Grundlagen d führung und V Physik	er Mathematik und elen /orbereitung auf die Moo	nentare Rechenmethoo dule der Theoretischer	den jenseits des Sch n Physik und der Klas	ulstoffes, insbesond ssischen bzw. Experi	lere zur Ein- mentellen	
Intended lear	ning outcomes					
German inten	ded learning outcomes	available but not trans	lated yet.			
Der/Die Studi techniken, we	erende verfügt über die elche in der Theoretische	Kenntnisse der Grund en Physik und der Expe	í lagen der Mathemati erimentellen Physik k	ik und der elementa benötigt werden.	ren Rechen-	
Courses (type	, number of weekly cont	act hours, language –	- if other than Germa	n)		
V (2) + Ü (2) +	V (2) + Ü (2)			,		
Module taugh	it in: German or English					
Method of as ster, informat	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) Exercises (b) Talk (appro	successful completion o ox. 15 minutes)	f approx. 50% of appr	ox. 13 exercise sheet	s) or		
Allocation of	places					
Additional inf	ormation					
Workload						
490 h						
180 1						
Teaching cyc	e					
Referred to in	LPOI (examination reg	ulations for teaching-o	degree programmes)			
§ 53 Nr. 1 a) § 77 Nr. 1 a)						
Module appe	ars in					
Bachelor's de	gree (1 major) Physics (2	2020)				
Bachelor's de	gree (1 major) Nanostru	cture Technology (202	o)			
Bachelor's de	gree (1 major) Mathema	tical Physics (2020)				
Bachelor's de	gree (1 major, 1 minor) F	'hysics (Minor, 2020)	Dhusies (2000)			
First state exa	imination for the teaching	ig degree Grundschule	Physics (2020)			
First state exa	mination for the teaching	is degree Realschule F	Physics (2020)			
First state exa	mination for the teachir	ng degree Mittelschule	Physics (2020)			
· 			· · ·			
LA Mittelschulen Phy	ysics (2020)	JMU Würzburg ● g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	. reg. data re- Physik - 2020	page 47 / 58	



Bachelor's degree (1 major) Quantum Technology (2021) exchange program Physics (2023) Bachelor's degree (1 major) Mathematical Physics (2024)

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Demonstration Laboratory Course 1 11-P-DP1-172-m01 Module coordinator Module offered by holder of the Chair of Physics and its Didactics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s)						
Module coordinator Module offered by holder of the Chair of Physics and its Didactics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s)						
holder of the Chair of Physics and its Didactics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s)						
ECTS Method of grading Only after succ. compl. of module(s)						
5 numerical grade						
Duration Module level Other prerequisites						
1 semester undergraduate						
Contents						
German contents available but not translated yet.						
Grundlegende Experimente des Physikunterrichts der Primar- bzw. Sekundarstufe I, Gerätekunde schultypisch Geräte, Zielsetzung und didaktisches Potential von Demonstrationsexperimenten, Schülerexperimenten, Frei handexperimenten, Modellexperimenten, etc.; rechnergestütztes Experimentieren; Messwerterfassung, inter- tive Bildschirmexperimente, etc.; Präsentation von Experimenten; Sicherheit im Physikunterricht, Präsentatio kompetenz.	her - ak- ns-					
Intended learning outcomes						
German intended learning outcomes available but not translated yet.						
Kompetenter Umgang mit handels- und schulüblichen Lehrgeräten und Experimentiermaterialien; Strategien zur systematischen Analyse von Fehlerquellen beim eigenen Experimentieren; Erkennen von Kategorien von Experi- menten, ihre Funktion und ihr didaktisches Potential; Erfahrung, Experimente lernziel- und schülerorientiert aus- zuwählen, aufzubauen und zu präsentieren sowie rechnergestützte Demonstrations- und Schülerexperimente einzusetzen: Sicherheitsvorschriften im Physikunterricht.						
Courses (type, number of weekly contact hours, language — if other than German)						
P (4)						
Method of assessment (type, scope, language — if other than German, examination offered — if not every seme- ster, information on whether module can be chosen to earn a bonus)						
a) oral examination of one candidate each (approx. 10 minutes) or b) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German and/or English						
Allocation of places						
Additional information						
Workload						
150 h						
Teaching cvcle						
<u></u>						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
§ 53 Nr. 1 c), § 77 Nr. 1 d)						
Module appears in						
First state examination for the teaching degree Grundschule Physics (2018)	_					
First state examination for the teaching degree Realschule Physics (2018)						
First state examination for the teaching degree Gymnasium Physics (2018)						
First state examination for the teaching degree Mittelschule Physics (2018)						
First state examination for the teaching degree Grundschule Physics (2020)						
First state examination for the teaching degree Gymnasium Physics (2020)						
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First state examination for the teaching degree Realschule Physics (2020) First state examination for the teaching degree Mittelschule Physics (2020)

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Module	e title				Abbreviation	
Data a	nd Erro	r Analysis			11-P-FR1-152-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
2	(not) s	successfully completed				
Duratio	on	Module level	Other prerequisites	•••••	c	(
1 seme	ester	undergraduate	Admission prerequi	site to assessment:	completion of exerci	ses (approx.
			approx, 50% of exer	rcises will qualify for	admission to asses	sment. The
			lecturer will inform	students about the r	espective details at	the beginning
			of the semester.			0 0
Conten	nts					
Types of and sta	of error andard	s, error approximation a deviation.	nd propagation, grapł	nic representations,	linear regression, m	ean values
Intend	ed lear	ning outcomes				
The stu statisti	udents and	are able to evaluate mea to draw, present and dis	suring results on the scuss the conclusions	basis of error propag	gation and of the pri	nciples of
Course	es (type	, number of weekly cont	act hours, language –	- if other than Germa	ın)	
V (1) + Module	Ü (1) e taugh	t in: Ü: German or Englis	h			
Metho ster, in	d of ass Iformati	sessment (type, scope, l ion on whether module o	anguage — if other th can be chosen to earn	an German, examina a bonus)	ition offered — if not	every seme-
written	exami	nation (approx. 120 min	utes)			
Langua	age of a	ssessment: German and	l/or English			
Allocat	tion of p	olaces				
Additio					<u> </u>	
kegistr this wil 3 Sente find tha gistrati ly regis sessme sessme	ation: I ll be co ence 4 at the s ion for a ster for ent was ent to w	r a student registers for nsidered a declaration of ASPO (general academic tudent has obtained the assessment into effect. (an assessment. Student s not put into effect will r hich he/she has not be	the exercises and obt of will to seek admissi and examination reg qualification for adm Only those students th s who did not register not be admitted to the en admitted, the grad	ains the qualification on to assessment pu ulations). If the mod ission to assessment nat meet the respect for an assessment of respective assessment e achieved in this as	I for admission to as ursuant to Section 20 ule coordinators sub it, they will put the s ive prerequisites car or whose registration tent. If a student tak asessment will not b	Seessment, Subsection Sequently tudent's re- n successful- n for an as- es an as- e considered.
Worklo	ad					
60 h						
Teachi	ng cycl	e				
			_			
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
§ 53 N § 77 N	Nr. 1 c) Nr. 1 d)					
Module	e appea	ars in				
Bachel Bachel Bachel	lor's de lor's de lor's de	gree (1 major) Mathema gree (1 major) Physics (2 gree (1 major) Nanostruc	tics (2015) 2015) Sture Technology (201	5)		
LA Mittelsc	chulen Phy	sics (2020)	JMU Würzburg • g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) I	1. reg. data re- Physik - 2020	page 51 / 58

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

Module title			Abbreviation			
Laboratory Course Physics A(Mechanics, Heat, Electromagnetism)				11-P-LA-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)		
2	(not) s	successfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Measu rents, h stant, c	rement neat ca drafting	tasks in mechanics, th pacity, calorimetry, der of graphs and drafting	ermodynamics and ele nsity of bodies, dynami g of measurement proto	ctricity theory, e.g. n c viscosity, elasticity cols.	neasurement of volta , surface tension, sp	ages and cur- pring con-
Intende	ed lear	ning outcomes				
The stu She is a the me	ident h able to asurem	as knowledge and mas plan experiments inde ient results in a measu	tery of physical measu pendently and to perfo rement protocol.	ring instruments and rm well in cooperatio	l experimental techn on with others, and t	iques. He/ to document
Course	s (type	, number of weekly cor	itact hours, language –	- if other than Germa	n)	
P (2)						
Metho ster, in	d of ass formati	s essment (type, scope, on on whether module	language — if other that can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
Prepari cessful can be candid pleted	ng, per ly com repeat ate's u can be	forming and evaluating oleted if a Testat (exan ed once. After complet nderstanding of the ph repeated once. Both c	g (record of readings or n) is passed. Exactly on ion of all experiments, t ysics-related contents o omponents of the asse	lab report) the expe e experiment that wa talk (with discussion of the module. Talks ssment have to be su	riments will be consi as not successfully c ; approx. 30 minutes that were not succes uccessfully complete	idered suc- ompleted s) to test the ssfully com- ed.
Allocation of places						
Additio	onal inf	ormation				
Worklo	ad					
60 h						
Teachi		•				
Teacini	ig tyti	e				
Referre	ed to in	LPOI (examination re	gulations for teaching-o	degree programmes)		
§ 53 N § 77 N	lr. 1 c) lr. 1 d)					
Module	e appea	irs in				
First sta	ate exa	mination for the teachi	ng degree Grundschule	Physics (2015)		
First state examination for the teaching degree Realschule Physics (2015)						
First state examination for the teaching degree Gymnasium Physics (2015)						
First state examination for the teaching degree Mittelschule Physics (2015)						
First state examination for the teaching degree Grundschule Physics (2018)						
First state examination for the teaching degree Realschule Physics (2018)						
First sta	FIRST STATE examination for the teaching degree Gymnasium Physics (2018)					
First sta	First state examination for the teaching degree Grundschule Physics (2018)					
ווזג זומני פאמוווומנוטוו וטו נוופ נפמנווווצ טפצופפ טועוועגנווענפ דוועגונג (2020)						
LA Mittelsc	hulen Phy	sics (2020)	JMU Würzburg • go cord Lehramt Mitt	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	. reg. data re- Physik - 2020	page 53 / 58



First state examination for the teaching degree Gymnasium Physics (2020) First state examination for the teaching degree Realschule Physics (2020) First state examination for the teaching degree Mittelschule Physics (2020)

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Module	e title				Abbreviation	
Labora	tory Co	urse Physics B (Electri	city, Circuits, Atomic a	nd Nuclear Physics)	11-P-LB-152-m01	
Module coordinator		Module offered by				
Managing Director of the Institute of Applied Physics		Faculty of Physics a	ind Astronomy			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	(not) s	successfully completed				
Duratio	on	Module level	Other prerequisites			
2 seme	ester	undergraduate	Students are highly	recommended to co	mplete modules 11-F	P-LA and 11-P-
			FR1 prior to complet	ing module 11-P-LB.		
Conten	Its					
Physica	al laws	of the science of electr	icity, circuits with elect	rical components an	d Atomic and Nucle	ar Physics.
Intend	ed lear	ning outcomes				
The stu	idents l	have knowledge and sl	ills of physical measur	ing instruments and	experimental techn	iques They
are abl	e to inc	lependently plan and c nent protocol.	onduct experiments in	cooperation with ot	hers, and to docume	int the results
Course	s (type	, number of weekly cor	itact hours, language –	- if other than Germa	ın)	
P (2) +	P (2)	· · · · · ·			-	
Metho ster, in	d 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-
Prepari cessful can be candid pleted	al assig ing, per lly com repeat ate's un can be	forming and evaluating forming and evaluating pleted if a Testat (exan ed once. After complet nderstanding of the ph repeated once. Both c	ox. 30 minutes) g (record of readings or i) is passed. Exactly on ion of all experiments, ysics-related contents omponents of the asse	lab report) the expe e experiment that wa talk (with discussion of the module. Talks ssment have to be su	riments will be cons as not successfully c i; approx. 30 minute that were not succe uccessfully complete	idered suc- ompleted s) to test the ssfully com- ed.
Allocat	ion of p	olaces				
Additic	nal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	e				
Referre	ed to in	LPOI (examination re	gulations for teaching-	degree programmes)		
§ 53 N § 53 N § 77 N	Vr. 1 b) Vr. 1 c) Vr. 1 d)	(3 ECTS credits) and c)	(2 ECTS credits)	,		
Module	e appea	ars in				
First st. First st First st. First st. First st. First st. First st. First st.	ate exa ate exa ate exa ate exa ate exa ate exa ate exa ate exa ate exa	mination for the teachi mination for the teachi	ng degree Grundschule ng degree Realschule F ng degree Gymnasium ng degree Mittelschule ng degree Grundschule ng degree Realschule F ng degree Gymnasium ng degree Mittelschule ng degree Grundschule	e Physics (2015) Physics (2015) Physics (2015) Physics (2015) Physics (2018) Physics (2018) Physics (2018) Physics (2018) Physics (2018) Physics (2020)		
LA Mittelso	hulen Phy:	sics (2020)	JMU Würzburg • g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	ı. reg. data re- Physik - 2020	page 55 / 58



First state examination for the teaching degree Gymnasium Physics (2020) First state examination for the teaching degree Realschule Physics (2020) First state examination for the teaching degree Mittelschule Physics (2020)

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Module title				Abbreviation		
MINT Preparatory Course Mathematical Methods of Physics			11-P-VKM-202-m01			
Module coordinator			Module offered by			
Managing Directors of the Institute of Applied Physics and			Faculty of Physics a	ind Astronomy		
the Ins	titute o	f Theoretical Physics a	nd Astrophysics		-	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
3	(not) :	successfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	Its					
Mather	matical	basics and elementary	calculus refreshing an modules of experiment	d extending knowled	dge from school, esp hysics	ecially as an
1. Basi	c geom	etry and algebra, 2. dif	ferential calculus and s	eries, 3. integral cal	culus, 4. vectors – di	rectional
quantit	ties, 5.	coordinate systems, 6.	complex numbers		••	
Intend	ed lear	ning outcomes				
Studen auired	nts are i for the	n command of knowled successful start into th	lge of basic mathemati e studies of experimen	cs and possess skill tal and theoretical p	s in elementary calc hysics.	ulus as re-
Course	s (type	number of weekly con	tact hours, language –	- if other than Germa	in)	
V (1) +	<u>ii</u> (2)	, number of weekly con)	
Module	e taugh	t in: German or English				
Metho ster. in	d of as format	sessment (type, scope, ion on whether module	language — if other the	an German, examina a bonus)	tion offered — if not	every seme-
a) exer	cises (successful completion	of approx. 50% of appr	ox. 6 exercise sheets	s) or	
b) talk	(appro	x. 15 minutes)			,,	
Assess	ment o	ffered: Once a year, wi	nter semester			
Allocation of places						
Additio	onal inf	ormation				
Worklo	ad					
90 h						
Teaching cycle						
Teachi	ng cycl	e: every year, winter se	mester			
Referred to in LPO I (examination regulations for teaching-degree programmes)						
§ 22 Nr. 1 h)						
§ 22	§ 22 II Nr. 2 f)					
§ 22 Nr. 3 f)						
Module appears in						
Bachelor's degree (1 major) Physics (2020)						
Bachelor's degree (1 major) Nanostructure Technology (2020)						
Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)						
First state examination for the teaching degree Grundschule 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)						
LA Mittelsc	hulen Phy	rsics (2020)	JMU Würzburg • g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	1. reg. data re- Physik - 2020	page 57 / 58



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

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