

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



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The subject is divided into

section / sub-section	FCTS credits	starting
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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

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- 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))





Scientific Discipline

(54 ECTS credits)

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Compulsory Courses

(54 ECTS credits)

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Classical Physics (23 ECTS credits)

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Module title				Abbreviation
Classical Phys	sics 1 (Mechanics)			11-E-M-152-m01
Module coord	inator		Module offered by	
Managing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	nd Astronomy
ECTS Metho	od of grading	Only after succ. com	pl. of module(s)	
8 nume	rical grade			
Duration	Module level	Other prerequisites		
1 semester	undergraduate	Admission prerequing 13 exercise sheets p approx. 50% of exer lecturer will inform s of the semester.	site to assessment: o er semester). Studen cises will qualify for students about the re	completion of exercises (approx. nts who successfully completed admission to assessment. The espective details at the beginning
Contents				
 Principles: I finition, meas Point Mech motion, free fa Newton's la mic scale, iso Work and e Elastic, inel and balances Conservativ and potential Rotational r gies to linear ti in the central Tidal forces gal force; Galilean tra postulates, pr pulse; Rigid body their stability, tation, the Ear Friction: St mation; Vibration: power approa vibration (reso 13. Coupled vi non-linear dyr Waves: Wa at the open ar relation; Elastic defi Fluids: Hyd Bernoulli equa pressive mode 	Physical quantities, prefa urement procedures, SI), anics: Kinematics, motion all, slate litter; circular mo- tws: Forces and momentu- tropic and anisotropic frid- nergy: (Kinetic) performa astic and super-elastic co- ystem, rocket equation; we and non-conservative fo of gravity (general relation notion: Angular momentu- translation, applications, potential; i: Inertial system, reference oblem of simultaneity, Lo- r and gyroscope: Determi- tensor on the example o th as a spinning top; atic and dynamic friction Representation by means ch, Taylor expansion, han onant case, Kriechfall, ap brations: Eigenvalues an namics and chaos; ave equation, transverse and closed end, speed of se ormation of solid bodies: drostatic pressure and bu- ation; Boyle-Mariotte, gas ulus; ory of gases: ideal and re- ion cross section, mean f	actors, derived quanti importance of metro n in 2D and 3D / vector otion in polar coordin um definition, weight ction. Preparation of the nce, examples; ollision: Energy and not force fields: Potential ons); um, angular velocity, satellites (geostation ce systems, apparent ssion to Maxwell's eq prentz transformation ning the centre of ma f the elasticity tensor , stick-slip motion, ro s of complex e-function remonic approximation eriodic limit), forced and longitudinal wav sound; interference, E Elastic modulus, gen toyancy, surface tens s laws, barometric he eal gas, averages, dis ree path, diffusion ar	ties, dimensional an logy; ors, special cases: U lates; vs. mass forces on t the equations of mot nomentum conserva , potential energy; la torque, rotational er nary and interstellar) forces, Foucault per uations, ether, Miche , time dilation and le ss, inertia tensor an , physics of the bike offing friction, viscour on, equation of motion ; spring and pendul vibration, Fourier an uble pendulum, dete es, polarisation, prir coppler effect; phase neral Hooke's law, el ion and contact angli ight formula, air present tribution functions, on a osmosis, degrees	alysis, time / length / mass (de- Iniform and constant accelerated he pendulum, forces on an ato- tion and solutions; tion, surges in centre of mass aw, weight scale, field strength hergy, moment of inertia, analo- b, escape velocities, trajectories indulum, Coriolis force, centrifu- elson interferometer, Einstein's ength contraction, relativistic im- d -ellipsoid, principal axes and ; gyroscope: Precession and nu- s friction, laminar flow, eddy for- on (DGL) on forces, torque and lum, physical pendulum, damped alysis; erministic vs. chaotic motion, heiple of superposition, reflection e and group velocity, dispersion lastic waves; le, capillary forces, steady flows, ssure, compressibility and com- equipartition theorem, Brownian of freedom, specific heat

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.

 $\mathbf{Courses}$ (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 is creditable for 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

mounte appears m		
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 teaching	ng degree Grundschule Physics (2015)	
First state examination for the teaching	ing degree Realschule Physics (2015)	
First state examination for the teaching	ng degree Gymnasium Physics (2015)	
First state examination for the teaching	ng degree Mittelschule Physics (2015)	
Bachelor's degree (1 major) Mathem	atical Physics (2016)	
First state examination for the teaching	ng degree Grundschule Physics (2018)	
First state examination for the teaching	ng degree Realschule Physics (2018)	
First state examination for the teaching	ng degree Gymnasium Physics (2018)	
First state examination for the teaching	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	atical Physics (2020)	
Bachelor's degree (1 major, 1 minor)	Physics (Minor, 2020)	
First state examination for the teaching	ng degree Grundschule Physics (2020)	
First state examination for the teaching	ng degree Gymnasium Physics (2020)	
First state examination for the teaching	ng degree Realschule Physics (2020)	
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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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Modu	Module title Abbreviation						
Classi	cal Phys	sics 2 (Heat and Electro	omagnetism)	_	11-E-E-152-m01		
Modu	le coord	inator		Module offered by			
Manag	ging Dire	ector of the Institute of	Applied Physics	plied Physics Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. cor	Only after succ. compl. of module(s)			
8	nume	rical grade					
Durati	on	Module level	Other prerequisites	5			
1 semester undergraduate		Admission prerequi 13 exercise sheets p approx. 50% of exe lecturer will inform of the semester.	Admission prerequisite to assessment: completion of exercises (approx. 13 exercise sheets per semester). Students who successfully completed approx. 50% of exercises will qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the semester.				
Conte	nts						
1. The 2. Hea 3. Fun 4. Hea 5. Rea phence 6. Elect point 4 7. Gau cial sy 8. Elect equipper lace e 9. Mat on, th 10. Ca dia in ectric 11. Elet 12. Rea ohmic 13. Cir suring 14. Po 15. Tra 16. Ma gnetic 17. Ve Helmh 18. Mo pole fit 19. ma ferrorr 20. inv induct 21. Ma equat 22. AC stance	rmodyna it condu dament it engine l gases omena (d ctrostati charge; ssian se ctrical po- totential ffects, S cter in th ermionia pacitor, the cap- displace ctricity, sistance , NTC, P cuits, el instrum wer and agnetost field; A ctor pot ooltz coi oving ch eld; mo atter in t agnetis ctricity, sistance field; A ctor pot ooltz coi oving ch eld; mo atter in t agnetis cance, se con; Maz ci capa ci c	amics (linked to 11-E-M ction, heat transfer, di al theorems of thermod es, working diagrams, e and liquids, states of m opalescence), coexiste cs, basic concepts: Ele entence, related to Cou- es; divergence and GS otential, working in the surfaces; several impo- egner wheel; he E-field, charge in a h c emission, dipole in h mirror charge, definition acitor; electrical polari- ement; electrolytic cap introduction, current de and conductivity, resi TC); ectrical networks, Kirch energy in the circuit; C echanisms, conduction tatics, fundamental law mper's Law, analogous ential, formal derivation ls; arge in the static magr vement paths, mass sp he magnetic field, effe m; magn. moment of ti Faraday's law of induce elf-induction; application displacement current, cwell equations; mentals, sinusoidal vil- citive & inductive resist); temperature and qua ffusion, convection, rac dynamics, entropy, irre- efficiency, example: Sti- natter (also solids), var nce region, Joule-Thom ectrical charge, forces; of alomb's law, definition in differential form; e E-box, electric. potent ortant examples: Spher- omogeneous field, Mill omogeneous and inhor on, capacity; plate and sation, displacement a acitor; Piezoelectric effi- lensity, drift velocity, co stivity, temperature de hhoff's rules (meshes, lge; Capacitor charge; galva n in solids: Band mode vs; permanent magnet, s to e-box, magn. river, n, analogous to electric hetic field, current balan bectrometer, Wien filter cts of the field on matter he electron, behaviour ction, Lenz's rule, flux co partions, amplitude, per for, capacitor and coil,	antity of heat, thermo diant heat; versibility, Maxwell's rling engine; n der Waals, critical p ison; electric field, reps. fie of "river"; Gaussian s ial, potential differer e, hollow sphere, cap likan experiment, Bra mogeneous field; inc spherical capacitor; nd orientation polari fect; onduction mechanist pendence; Ohm's lar nodes); internal resis nic element; thermo l, semiconductor; lin field properties, def swirl; c scalar potential; ca nce, Lorentz force, rig rs, Hall effect; electro er, relative permeabi at interfaces; change, eddy electric rator; rea, displacement cu eriod and phase; pow phase shift and frequ	ometer, Kelvin scale; demon; ooint, phase transition eld concept, field lin surface, divergence of noce, voltage; potenti bacitor plates, electron aun tube; electron: F fluction, Faraday cag combination of cap sation, microscopic ms; w; realisations (resist stance of a voltage s voltage; re in liquids and gas initions and units; E lculation of fields, e ght-hand rule, electron is; e / m determinat lity, susceptibility; p field, Waltenhofen's ver and RMS value, o uency dependence;	ons, critical es, field of a theorem; spe- al equation, ic dipole; "ield emissi- e; acitors; me- image; diel- stive and non- source, mea- es; arth's ma- xamples, ic motor; di- ion; bara-, dia-, s pendulum; ension, wave ohmic resi- impedance:	
Comp	lex 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 is creditable for bonus)

written examination (approx. 120 minutes) Language of assessment: German and/or English

Allocation of places

Additional information

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

Workload

240 h

Teaching cycle

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

§ 53 l Nr. 1 a)

§ 77 | Nr. 1 a)

Module appears in

Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) First state examination for the teaching degree Grundschule Physics (2015) First state examination for the teaching degree Realschule Physics (2015) First state examination for the teaching degree Gymnasium Physics (2015) First state examination for the teaching degree Mittelschule Physics (2015) Bachelor's degree (1 major) Mathematical Physics (2016) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Realschule Physics (2018) First state examination for the teaching degree Gymnasium Physics (2018) First state examination for the teaching degree Gymnasium 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 Mittelschule Physics (2018) First state examination for the teaching degree Mittelschule Physics (2018) First state examination for the teaching degree Mittelschule Physics (2018) Bachelor's degree (1 major) Physics (2020)

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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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LA Mittelschulen Physics (2020)

Module	title				Abbreviation	
Optics a	Optics and Waves 11-L-OW-172-mo1					
Module	coord	inator		Module offered by		
Managi	ng Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	ind Astronomy	
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)		
7	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	undergraduate	Admission prerequi 13 exercise sheets p approx. 50% of exer lecturer will inform s of the semester.	Admission prerequisite to assessment: completion of exercises (approx. 13 exercise sheets per semester). Students who successfully completed approx. 50% of exercises will qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the semester		
Content	ts					
 Light Light Const sorpt Geom plane louse Geom Geom Optice Optice Optice Type Optice Optice Son, I Diffra Rayle Rayle and r Diffra Rayle Rayle Son, I Diffra Rayle Rayle Son, I Diffra Rayle Failur Sis; p quan Failur ves (I 10Wave quist cess Schröt 11.Math son to value energy of QM 	: (linke in mat tant; al ion, bi netrica e interf dispers a interf dispers cal inst s. imag optics offile), t Mach-2 action i sigh & 2 action i cal inst s. imag optics offile), t Mach-2 action i , near- re of cl bhotoel tum st re of cl Daviss e mech -Shanr in qua odinge e equat gy quan A (state	ed to 11-E-E): Basic concepter: Propagation velocity boorption, Kramers-Kroni refringence, optical activ l optics: Basic concepts, aces, Snell's law, total re- sion, curved interfaces, th (spherical & chromatic al- ruments: Characteristics, ge construction (electron 5: spatial and temporal co- hin layers, parallel layers Zender, Fabry-Perot); n the far field: Fraunhofe Abbé criterion, Fourier op- ion, diffraction off atomic n the near field: Fresnel of field microscopy, hologra assical physics I - from lig- lectric effect and Einstein ructure of nature; assical physics II - particl on-Germer-experiment, d anics: Wave packets, pha- non theorem, wave functi ntum mechanics (double r's cat); cal concepts of quantum e optics, free particle and cion, simple examples in ntisation, harmonic oscill es, operators, observable	pts, the speed of ligh in the medium; disp- g relation, interfaces ity (dipole); Fermat's principle, op flection, optical tunn hin and thick lenses, perration, astigmatism , camera, eye, magnif lenses, electron micr oherence, double slit s, wedge-shaped laye r diffraction, single slit s, wedge-shaped laye r diffraction, near-field aphy, Huygens-Fresne ght wave to photon: E 's explanation, Comp les as waves: De Brog ouble slit interference ase and group velocit on as probability am -slit experiment & wh mechanics: Schrödin particles in a potential 1D (potential step, pot lator), box potential i es).	t, Huygens-Fresnel p ersion, complex and , Fresnel equations, ptical path, Gaussian eling, evanescent wa lens systems, lens g m, coma, distortion, ying glass, microsco oscope), confocal m , Young's experimen rs, phase shift, New lit, intensity distribut n-fold slit, intensity of theorem; diffraction at circula el concept; white ligh Black body radiation oton effect, light as a glie's matter wave co e); cy (recap of 11-EM), u plitude, probability of ich-way information ger equation as wav fal, time-independen otential barrier and ti n higher dimensions	principle, reflection, refraction; frequency-dependent dielectric polarisation, generation by ab- n optics, reflection, refraction, aves, prism; normal and anoma- grinder formula, aberrations, ima- correction approaches); ope, telescope types, bundle be- icroscopy; t, interference pattern (intensi- ton rings, interferometer (Michel- tion, apertures, resolving power: distribution, grating spectrometer ar apertures/disks, Fresnel zone nt hologram; and Planck's quantum hypothe- a particle, wave-particle duality, oncept; diffraction of particle wa- incertainty principle, Ny- of residence, measurement pro- n, collapse of the wave function, e equation, conceptual compari- nt Schrödinger equation as eigen- unnel effect, box potential and a and degeneracy, formal theory	
Intende	d lear	ning outcomes				
The stur phenon structur and cor tum phe	dents i nena a re and ncepts enome	understand the basic prir s well as Atomic and Mol application of important of quantum theory and A na. They are able to discu	nciples and contexts ecular Physics. They optical instruments a strophysics and the uss their knowledge a	of radiation, wave ar understand the theo and measuring methe relevant experiments and to integrate it inf	nd quantum optics and quantum pretical concepts and know the ods. They understand the ideas is to observe and measure quan- to a bigger picture.	

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 ${f Courses}$ (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 is creditable for 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 | 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)

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Structure of material

(11 ECTS credits)

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Module title					Abbreviation	
Modern Physics 1 11-L-M1-NV-172-m01						
e coord	inator		Module offered by			
ing Dire	ector of the Institute of	he Institute of Applied Physics		nd Astronomy		
Metho	od of grading	Only after succ. compl. of module(s)				
nume	rical grade					
on	Module level	Other prerequisites				
ester	undergraduate					
nts						
ts 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), cielectro y with n wave fi- nents, A t-matte rix elem ct, collis R: elen s light a equatio 4-level r-shell o spectru ges, x-ra ecules a on and tal vs. F Waals b ecule ro l molec vibratic ecular s effect, adents n tal vs. F Waals b ecule ro l molec vibratic ecular s effect, adents n chants n tal vs. F	atoms: experimental e botopes, internal structure echanical foundations vave functions and prote in the atom, Franck-H ödinger equation. ativistic hydrogen atom um in QM, Schrödinger umbers, energy eigenva- ternal fields: orbital ma- rical fields: Stark effect perfine structure: electron a spin resonance (ESR) nuclear spin and hyper on atoms: helium atom respect to particle exch unction of two-particle unfbau principles and H r interaction: time-deper ents and dipole approx- sion broadening), atom nentary optical process amplification, Einsteinter ons, population inversion lasers, examples (ruby excitations and x-ray pf m, x-ray emission for elay photoemission, non- and chemical bonding: LCAO approach, bondi leitler-London approxim onds and Lennard-Jone tations and vibrational pectroscopy: transition vibrational-rotational to manderstand the basic p s. They understand the nents and measuring m	evidence for the existent ure, Rutherford experim of atomic physics (sho pability interpretation, lertz experiment, atomic equation of the H-atomic agnetic dipole moment t. ronic spin and magnetic e Dirac equation (spin , spin-orbit coupling, re- fine structure. as simplest example, i ange, fermions and bo systems (spin singlets und's rules. endent perturbation the kimation, selection rule ic spectroscopy. es (absorption, sponta s rate equations, therm on, and laser condition laser, He-Ne laser, sen nysics: generation of x- lemental analysis (EDX radiative Auger process molecular hydrogen io ng and antibonding mo- nation, biatomic hetero es potential, (time allow Born-Oppenheimer ap ing/expansion, molecu- rotational interaction. matrix elements, vibra ransitions: Fortrat diag	ace of atoms, size of thent, instability of the ort recap of part A.): If uncertainty relation a fic spectra, Bohr's more spectra, Fermi's Golden es and symmetry, line and triplets), LS- and spectro spectra spe	the atom, charges are e "classical" Rutherf ight as particle bean and stability of the a odel and its limitation al-symmetric potent dial and angular wa magentic fields: no n-Gerlach experimer menon and existence ure, Lamb shift (qua f identical particles, spin, Pauli principle d jj-coupling, periodi Rule) and optical tra- e broadening (lifetim ed emission), stimula equilibrium characte of a laser, optical pu strahlung and chara nd contrast formatio iation, application e example: rigid molece lrogen molecule (H2) covalent vs. ionic bo lecules). tator (symmetric ano oscillator, Morse pot : infrared spectrosco itions: Franck-Conde ena as well as Atom re and application of ncepts of quantum t	nd masses in ford atom n, particles tom, energy ns, non-rela- ial and angu- ve functions, rmal Zeeman nt, Ein- e of antimat- ntum electro- (anti)sym- e, orbital and fc table of the ansitions, ne, Doppler ated emissi- er of a laser: imping, 2-, 3- icteri- n in x-ray xamples. cule approxi- b: molecular onding, van d unsymme- ential, nor- py and Ra- on principle. ic and Mo- f important heory and	
.,		cord Lehramt Mit	telschulen (Unterrichtsfach) P	Physik - 2020		
	title Physic Coord ing Dire A ecoord ing Dire Metho numer Ster ts ture of tom, is aves, w tization ic Schr non-rela onent its coment its coment its electro mics), ielectro y with r wave fil ents, A electro mics), ielectro y with r wave fil ents, A electro mics), ielectro y with r wave fil ents, A enter is elem t, collis R: elem t, collis Caller t, collis r-shell o collis cule ro locule ro l	e title n Physics 1 e coordinator ing Director of the Institute of Method of grading numerical grade on Module level ster undergraduate ts	e title Physics 1 Coordinator Ing Director of the Institute of Applied Physics Method of grading Only after succ. con numerical grade In Module level Other prerequisites ster Undergraduate ts Cure of atoms: experimental evidence for the exister tom, isotopes, internal structure, Rutherford experin ntum mechanical foundations of atomic physics (sho aves, wave functions and probability interpretation, tization in the atom, Franck-Hertz experiment, atomi is Schrödinger equation. Inon-relativistic hydrogen atom: hydrogen and hydrog formentum in QM, Schrödinger equation of the H-ator itum numbers, energy eigenvalues. Is in external fields: Orbital magnetic dipole moment t, electrical fields: Stark effect. and hyperfine structure: electronic spin and magneti -de Haas effect, glimpse of the Dirac equation (spin electron spin resonance (ESR), spin-orbit coupling, r mics), nuclear spin and hyperfine structure. ielectron atoms: helium atom as simplest example, i y with respect to particle exchange, fermions and bo wave function of two-particle systems (spin singlets ents, Aufbau principles and Hund's rules	etitle Module offered by recoordinator Module offered by ing Director of the Institute of Applied Physics Faculty of Physics a Method of grading Only after succ. compl. of module(s) numerical grade on Module level Other prerequisites ster undergraduate tom, isotopes, internal structure, Rutherford experiment, instability of th ntum mechanical foundations of atomic physics (short recap of part A.): I aves, wave functions and probability interpretation, uncertainty relation at intum numbers, energy eigenvalues. sic Schrödinger equation. non-relativistic hydrogen atom: hydrogen and hydrogen-like atoms, centr num numbers, energy eigenvalues. sin external fields: orbital magnetic dipole moment, gyromagnetic ratio, t, electrical fields: Stark effect. and hyperfine structure: electronic spin and magnetic spin moment, Ster -de Haas effect, glimpse of the Dirac equation (spin as relativistic pheno electron spin resonance (ESR), spin-orbit coupling, relativistic fine structure. electron atoms: helium atom as simplest example, indistinguishability or y with respect to particle exchange, fermions and bosons, relationship to wave function ftwo-particle systems (spin singlets and triplets), LS- and enst, selfortang, and hyperfire structure. electron atoms: helium atom as simplest example, indistinguishability or y with r	etitle Abbreviation 1 Physics 1 11-L-M1-NV-172-m0 c coordinator Module offered by ing Director of the Institute of Applied Physics Faculty of Physics and Astronomy Method of grading Only after succ. compl. of module(s) numerical grade n Module level Other prerequisites ster undergraduate ts ts ts true of atoms: experimental evidence for the existence of atoms, size of the atom, charges at stracture, Rutherford experiment, instability of the "classical" Rutherf non-relativistic hydrogen atom: hydrogen and hydrogen-like atoms, central-symmetric potent toomentum in QM, Schrödinger equation of the H-atom, atomic orbitals, radial and angular was turn numbers, energy eigenvalues. sis in external fields: orbital magnetic dipole moment, gyromagnetic ratio, magentic fields: not, electrical fields: Stark effect. and hyperfine structure: electronic spin and magnetic spin moment, Stern-Gerlach experimer de Haas effect, gimpse of the Dirac equation shos as relativistic phenomenon and existence enst. Neuros shellum atom as simplest example, indistinguishability of identical particles, ywith respect to particle exchange, fermions and bosons, relationship to spin, Pauli principle wave functin of two-particle systems (sp	

Astrophysics and the relevant experiments to observe and measure quantum phenomena. They are able to discuss their knowledge and to integrate it into a bigger picture.

 $\mathbf{Courses}$ (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 is creditable for 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)

Module title				Abbreviation	
Modern Physics 2 11-L-M2-NV-172-m01					
Module coordinato	or		Module offered by		
Managing Director	of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of	grading	Only after succ. com	pl. of module(s)		
5 numerical	grade				
Duration Mod	lule level	Other prerequisites			
2 semester und	ergraduate				
Contents					
German contents a	vailable but not tran	slated yet.			
Mechanische, diele tronische Anregung gen, Thermische Ei	ektrische und magne g von Molekülen, Me genschaften von Iso	etische Eigenschafter ssmethoden, Struktu latoren.	n von Molekülen, Rot ur von Festkörpern, S	ations-,Schwingungs- und elek- treumethoden, Gitterschwingun-	
Intended learning	outcomes				
German intended le	earning outcomes av	/ailable but not trans	lated yet.		
Verständnis des Au den zur Untersuchu translationsinvaria	ufbaus von Moleküle ung von Molekülen, ^v ntes Gitter und der K	en und der chemische Verständnis des Aufb Konsequenzen.	en Bindung, Verständ baus kristalliner Fest	dnis der experimentellen Metho- körper, ihrer Modellierung als	
Courses (type, number	r of weekly contact hours, la	anguage — if other than Ger	man)		
V (4) + Ü (1) Module taught in: İ	Ü: German or English	1			
Method of assessn module is creditable for b	nent (type, scope, languag ponus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) written examinat b) oral examinatior	tion (approx. 90 to 1 1 of one candidate e	20 minutes) or ach (approx. 20 minu	ites)		
Language of assess	sment: German and/	or English			
Allocation of place	5				
Additional informa	tion				
Workload					
150 h					
Teaching cycle					
Referred to in LPO	(examination regulations	s for teaching-degree progra	mmes)		
§ 53 Nr. 1 b)					
Module appears in					
First state examina	tion for the teaching	degree Grundschule	Physics (2018)		
First state examina	tion for the teaching	g degree kealschule P r degree Mittelschule	mysics (2018) Physics (2018)		
First state examina	tion for the teaching	degree Grundschule	Physics (2020)		
First state examina	tion for the teaching	degree Realschule P	hysics (2020)		
First state examina	tion for the teaching	degree Mittelschule	Physics (2020)		

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Computational Methods

(6 ECTS credits)

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Module title					Abbreviation		
Mathematical Methods of Physics 11-M-MR-202-m01							
Module	e coord	inator		Module offered by	Module offered by		
Managi and Ast	ing Dire trophys	ector of the Institute of sics	Theoretical Physics	Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
6	(not) s	successfully completed	1				
Duratio	n	Module level	Other prerequisites				
2 seme	ster	undergraduate					
Conten	ts	undergradute					
Germar Grundla führung	n conte agen de g und V	nts available but not ti er Mathematik und ele orbereitung auf die Mo	ranslated yet. mentare Rechenmetho odule der Theoretischei	den jenseits des Sch n Physik und der Klas	ulstoffes, insbesond ssischen bzw. Experi	lere zur Ein- mentellen	
Physik Intende		ning outcomes					
Gormar	- inton	ad loarning outcomes	available but not tran	alated yet			
Der/Die technik	e Studio ken, we	erende verfügt über die lche in der Theoretisch	e Kenntnisse der Grund en Physik und der Exp	lagen der Mathemati erimentellen Physik k	k und der elementar benötigt werden.	ren Rechen-	
Course	S (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)			
V (2) + Module	Ü (2) + e taugh	V (2) + Ü (2) t in: German or English					
Method	d of ass	sessment (type, scope, lang	guage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
module is	creditab	le for bonus)					
a) Exero b) Talk	cises (s (appro	successful completion x. 15 minutes)	of approx. 50% of appr	ox. 13 exercise sheet	s) or		
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
180 h							
Teachi	ng cycl	e					
	3 0 0 0	-					
Referre	d to in	IPOI (examination regulation	ons for teaching-degree progra	ammec)			
§ 53 N	lr. 1 a)			annies)			
§ 77 Nr. 1 a)							
Module	e appea	Irs In	(2222)				
Bachel	or's deg or's deg	gree (1 major) Physics	(2020) Joture Technology (202	O)			
Bachelor's degree (1 major) Natiostructure rechnology (2020) Bachelor's degree (1 major) Mathematical Physics (2020)							
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)							
First sta	First state examination for the teaching degree Grundschule Physics (2020)						
First sta	First state examination for the teaching degree Gymnasium Physics (2020)						
First sta	First state examination for the teaching degree Realschule Physics (2020)						
First sta	ate exa	mination for the teachi	ng degree Mittelschule	e Physics (2020)			
LA Mittelsc	A Mittelschulen Physics (2020) JMU Würzburg • generated 19-Apr-2025 • exam. reg. data re- cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020						





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

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Laboratory Course I

(9 ECTS credits)

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Module title		Abbreviation				
Labora	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		oplied Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. compl. of module(s)			
2	(not) s	successfully completed		•		
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conter	its					
Measu rents, l stant, o	rement neat ca drafting	tasks in mechanics, ther pacity, calorimetry, densi of graphs and drafting o	modynamics and ele ity of bodies, dynami f measurement proto	ctricity theory, e.g. n c viscosity, elasticity cols.	neasurement of volta , surface tension, sp	ages and cur- pring con-
Intend	ed lear	ning outcomes				
The stu She is the me	ident h able to asurem	as knowledge and maste plan experiments indepe nent results in a measure	ry of physical measu endently and to perfo ment protocol.	ring instruments and rm well in cooperatio	experimental techn on with others, and t	iques. He/ o document
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
P (2)						
Metho module i	d of ass s creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, informati	on on whether
Prepar cessfu can be candid pleted	ing, per Ily com repeat ate's u can be	forming and evaluating (pleted if a Testat (exam) i ed once. After completion nderstanding of the phys repeated once. Both com	record of readings or is passed. Exactly on n of all experiments, t ics-related contents of nponents of the asses	lab report) the expense e experiment that was talk (with discussion of the module. Talks assment have to be su	riments will be consi as not successfully co ; approx. 30 minutes that were not succes uccessfully complete	dered suc- ompleted s) to test the ssfully com- ed.
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
60 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
§ 53 N § 77 N	Ir. 1 c) Ir. 1 d)					
Modul	e appea	ars in				
First st	ate exa	mination for the teaching	g 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 St	First state examination for the teaching degree Gymnasium Physics (2018)					
First st	Tist state examination for the teaching degree MittelsChule Physics (2018)					
LA Mittelso	hulen Phy	sics (2020)	JMU Würzburg • ge	enerated 19-Apr-2025 • exam	. reg. data re-	page 26 / 71
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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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	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Module title			Abbreviation			
Data and Error Analysis 11-P-FR1-152-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				
Durati	on	Module level	Other prerequisites	i		
1 seme	ester	undergraduate	Admission prerequi 13 exercise sheets p approx. 50% of exe lecturer will inform of the semester.	site to assessment: oer semester). Stude rcises will qualify for students about the re	completion of exerci nts who successfully admission to asses espective details at t	ses (approx. / completed sment. The the beginning
Conter	nts					
Types and sta	of errors andard	s, error approximation deviation.	and propagation, grapl	nic representations,	linear regression, me	ean values
Intend	ed lear	ning outcomes				
The stu statist	udents a ics and	are able to evaluate me to draw, present and d	asuring results on the iscuss the conclusions	basis of error propag	gation and of the prin	nciples of
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V (1) + Modul	Ü (1) e taugh	t in: Ü: German or Engl	sh			
Metho module i	d of ass s creditab	sessment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
writter Langua	examinates of a	nation (approx. 120 min ssessment: German ar	nutes) d/or English			
Alloca	tion of p	olaces				
Additional information						
Registr this wi 3 Sent find th gistrat ly regis sessm sessm	ration: I ll be co ence 4 / at the s ion for a ster for a ent was ent to w	f a student registers fo nsidered a declaration ASPO (general academ tudent has obtained th assessment into effect. an assessment. Studer not put into effect will which he/she has not b	the exercises and obt of will to seek admissi c and examination reg e qualification for adm Only those students th ts who did not register not be admitted to the een admitted, the grad	ains the qualification on to assessment pu ulations). If the mod ission to assessmen nat meet the respect for an assessment of respective assessm e achieved in this as	n for admission to as irsuant to Section 20 ule coordinators sub it, they will put the s ive prerequisites car or whose registration ent. If a student take isessment will not be	Sessment, Subsection Sequently tudent's re- Successful- for an as- es an as- e considered.
Worklo	ad					
60 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)		
§ 53 N § 77 N	Nr. 1 c) Nr. 1 d)					
Module appears in						
Bache Bache Bache	or's de or's de or's de	gree (1 major) Mathema gree (1 major) Physics (gree (1 major) Nanostru	atics (2015) 2015) Icture Technology (201	5)		
LA Mittelso	chulen Phy	sics (2020)	JMU Würzburg • g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	. reg. data re- Physik - 2020	page 28 / 71

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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 B (Electricity, Circuits, Atomic and Nuclear Physics) 11-P-LB-152-m01						
Module coordinator Module offered by						
Managing Director of the Institute of Applied Physics		pplied Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
E	(not)	successfully completed		<u></u>		
Duratio	nn		Other prerequisites			
	octor	undorgraduato	Students are highly	racammandad ta ca	mplata madulas da F	A and 44 D
2 Sellie	ester		FR1 prior to complet	ing module 11-P-LB.		
Conten	Its					
Physica	al laws	of the science of electric	city, circuits with elect	rical components an	d Atomic and Nuclea	ar Physics.
Intend	ed learı	ning outcomes				
The stu are abl in a me	idents l e to inc easuren	have knowledge and ski lependently plan and cc nent protocol.	lls of physical measur nduct experiments in	ing instruments and cooperation with oth	experimental techni ners, and to docume	ques. They nt the results
Course	S (type, n	number of weekly contact hours,	language — if other than Ger	rman)		
P (2) +	P (2)					
Metho module is	d of ass s creditab	sessment (type, scope, langu le for bonus)	age — if other than German, o	examination offered — if no	t every semester, informati	on on whether
Prepari cessful can be candid pleted	ing, per lly com repeate ate's ui can be	forming and evaluating pleted if a Testat (exam) ed once. After completion nderstanding of the phy repeated once. Both co	(record of readings or is passed. Exactly on on of all experiments, sics-related contents mponents of the asses	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	dered suc- ompleted s) to test the ssfully com- ed.
Allocat	ion of p	olaces				
Additic	onal inf	ormation				
Worklo						
WOIKIU			-			
150 n			_			
Teachi	ng cycl	e	-			
			_			
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
§ 53 N § 53 N § 77 N	Nr. 1 b) (Nr. 1 c) Nr. 1 d)	(3 ECTS credits) and c) (3	2 ECTS credits)			
Modul	e appea	urs in				
First st	ate exa	mination for the teachin	g 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 st	ate exa	mination for the teachin	g degree Grundschule	Physics (2018)		
First state examination for the teaching degree Realschule Physics (2018)						
First st	First state examination for the teaching degree Gymnasium Physics (2018)					
FIRST ST	First state examination for the teaching degree Mittelschule Physics (2018)					
LA Mittelso	ate exa :hulen Phy	sics (2020)		enerated 10-Apr-2025 • exam	. reg. data re-	page 30 / 71
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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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Laboratory Course II

(5 ECTS credits)

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Modul	Module title Abbreviation					
Demor	Demonstration Laboratory Course 1 11-P-DP1-172-m01					
Modul	Module coordinator			Module offered by		
holder	older of the Chair of Physics and its Didactics Faculty of Physics and Astronomy		nd Astronomy			
ECTS	Metho	od of grading	Only after succ. compl. of module(s)			
5	numerical grade					
Durati	on	Module level	Other prerequisites			
1 Seme	ester	undergraduate				
Conter	nts	undergraduate	1			
Germa	in conte	nts available but not trai				
Grundl Geräte hande tive Bi kompe	legende e, Zielse xperime ldschirn etenz.	Experimente des Physik tzung und didaktisches F enten, Modellexperiment nexperimente, etc.; Präse	unterrichts der Prima Potential von Demons en, etc.; rechnergesti entation von Experim	n- bzw. Sekundarstu strationsexperimente ütztes Experimentier enten; Sicherheit im	fe I, Gerätekunde sc en, Schülerexperime en; Messwerterfassu Physikunterricht, Pr	hultypischer nten, Frei- ung, interak- äsentations-
Intend	led lear	ning outcomes				
Germa	in inten	ded learning outcomes a	vailable but not trans	slated yet.		
Kompe systen mente zuwäh einzus	etenter l natische n, ihre f llen, auf setzen; S	Jmgang mit handels- un en Analyse von Fehlerque Funktion und ihr didaktis Fubauen und zu präsent Sicherheitsvorschriften ir	d schulüblichen Lehr ellen beim eigenen Ex ches Potential; Erfah ieren sowie rechnerg n Physikunterricht.	geräten und Experim perimentieren; Erker rung, Experimente le estützte Demonstrat	entiermaterialien; Si nnen von Kategorien rnziel- und schülero ions- und Schülerexj	trategien zur von Experi- rientiert aus- perimente
Course	es (type, r	number of weekly contact hours,	language — if other than Gei	rman)		
P (4)						
Metho module i	d of ass is creditab	eessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, informati	ion on whether
a) oral b) oral	examin examir	ation of one candidate e	ach (approx. 10 minu of 2. approx. 10 minu	ites) or tes per candidate)		
Langua	age of a	ssessment: German and	/or English	···· p ··· ······,		
Alloca	tion of p	olaces				
Additi	onal inf	ormation				
Workle	nad					
150 h						
Teachi	ing cycl	0	-			
Teacin	ing cyci	e				
Referr	ed to in	IPOI (examination regulation	s for teaching dogree progre	ummec)		
8 roll	$\frac{\mathbf{e}\mathbf{u} \cdot \mathbf{v}}{\mathbf{N}\mathbf{r} \cdot 1 \cdot \mathbf{c}}$	8 77 Nr. 1 d)	s for teaching-degree progra	innies)		
Modul						
First st	tato ova	IIS III mination for the teaching	a dogroo Grundschuld	Physics (2018)		
First state examination for the teaching degree Grundschule 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)						
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 33 / 71





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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Teaching

(12 ECTS credits)

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Compulsory Courses

(12 ECTS credits)

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Module title			Abbreviation			
Physic	Physics Teaching Concepts 11-L-PD-172-m01					
Module coordinator			Module offered by			
holder of the Chair of Physics and its Did		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			
2 seme	ester	undergraduate				
Conten	Contents					
Teachin of the of subject sics co typical these; the sci	Teaching of basic concepts of physics education and didactic consolidation of subject-relevant scientific content of the degree programme. Justification/legitimation of physics teaching; educational objectives of physics as a subject; competence models and educational standards; elementarisation and didactic reconstruction of phy- sics content; methods and media in physics lessons and their use to promote learning; student perceptions and typical learning difficulties in the subject areas of physics relevant to teaching and teaching concepts based on these; dealing with student perceptions; teaching approaches to the structure and cognitive/working methods of					
Intend	ed learı	ning outcomes				
Studer They cl familia critical	nts are f early di r with s ly discu	amiliar with central phy fferentiate didactic asp ubject-specific student uss specific teaching co	vsics teaching concept pects of physics lesson conceptions and their ncepts against this ba	s to design target gro s from scientific and r significance for the ckground.	oup-orientated physi educational aspect: students' learning p	ics lessons. s. They are rocess. They
Course	S (type, n	umber of weekly contact hours	s, language — if other than Ge	rman)		
V (2) +	V (2) +	Ü (1)				
Metho module is	d of ass s creditab	essment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) writt b) oral c) oral d) term Langua	en exar examin examin paper age of a	nination (approx. 60 m ation of one candidate ation in groups (groups (approx. 8 pages) ssessment: German an	inutes) or each (approx. 15 minu s of 2, approx. 15 minut d/or English	ites) or tes per candidate) or		
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
§ 36 Nr. 7 § 38 Nr. 1 § 53 Nr. 2 § 77 Nr. 2						
Module	e appea	ars in				
First st First st First st	ate exa ate exa ate exa	mination for the teachi mination for the teachi mination for the teachi	ng degree Grundschule ng degree Grundschule ng degree Realschule F	e Physics (2018) e Didactics in Physics Physics (2018)	s (Primary School) (2	2018)
LA Mittelsc	hulen Phy	sics (2020)	- JMU Würzburg ● g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) P	. reg. data re- hysik - 2020	page 37 / 71

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 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)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data re- cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	page 38 / 71

Module title			Abbreviation			
Physics	Physics Teaching Concepts Seminar 11-L-PDS-NV-152-m01					01
Module coordinator			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. cor	npl. of module(s)		
2	(not) s	successfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts	<u>.</u>				
Differer educati media a method	nt topic ion, ev and the ds, new	cs of current subject-dic aluation, task culture, i eir application for learn v teaching methods.	lactic research; examp nterdisciplinary classe ing support, especially	les: Interest and phy s, language in physic regarding computer	rsics education, girls cs education, effects s, epistemological a	in physics of subject nd working
Intende	ed lear	ning outcomes				
Knowle knowle and to	dge of dge of discus	selected methods of di didactic physical litera s different prioritisation	dactic physical resear ture. Ability to critically s and approaches.	ch, evaluation of did v evaluate Physics cla	actic physical resear asses in view of diffe	rch projects, erent aspects
Course	S (type, r	number of weekly contact hours	s, language — if other than Ge	rman)		
S (2)						
Methoo module is	d of ass creditab	sessment (type, scope, lang ble for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
b) oral c) oral d) term Langua	en examir examir paper ge of a	nation of one candidate nation in groups (groups (approx. 8 pages) sssessment: German an	each (approx. 10 minu s of 2, approx. 10 minu d/or English	utes) or tes per candidate) or	r	
Allocat	ion of J	places				
Additio	nal inf	ormation				
Worklo	ad					
60 h						
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	ammes)		
§ 53 N	lr. 2					
Module	e appea	ars in				
First sta	ate exa	mination for the teachi	ng degree Grundschule	e Physics (2015)		
First state examination for the teaching degree Realschule Physics (2015)						
First state examination for the teaching degree Mittelschule Physics (2015)						
First sta	ate exa	mination for the teaching	ng degree Realschule I	Physics (2018)		
First sta	ate exa	mination for the teaching	ng 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 sta	ate exa	mination for the teaching	ng degree Mittelschule	Physics (2020)		
LA Mittelsc	hulen Phy	rsics (2020)	JMU Würzburg • g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	. reg. data re- Physik - 2020	page 39 / 71

Module title			Abbreviation			
Student Lab Preparation Course (Physics) 11-L-L3S-152-m01						
Module	e coord	inator		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. com	pl. of module(s)		
5	nume	rical grade		• • • •		
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts	U	•			
The module gives an overview of applicable physical experiments that provide an introduction to science and can be performed in teaching-learning-laboratories (M!ND center). In these experiments, different working methods are employed.						
Intende	ed learı	ning outcomes				
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.						
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	man)		
S (5)						
Methoo module is	d of ass s creditab	essment (type, scope, langu le for bonus)	age — if other than German, e	examination offered — if no	t every semester, informati	on on whether
a) writt b) oral c) oral d) term e) portf Langua	en exar examin examin paper folio (10 ige of a	mination (approx. 45 mil ation of one candidate o ation in groups (groups (approx. 8 pages) or o to 15 hours total) ssessment: German and	nutes) or each (approx. 10 minu of 2, approx. 10 minut I/or English	tes) or tes per candidate) or		
Allocat	ion of p	olaces				
Additio	onal info	ormation				
Worklo	ad					
150 h						
Teachi	ng cycl	e	-			
Referre	ed to in	LPOI (examination regulation	ns for teaching-degree progra	mmes)		
§ 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 sta	ate exa	mination for the teachin	g degree Grundschule	Physics (2018)		
First sta	ate exa	mination for the teachin	g degree Realschule F	hysics (2018)		
First sta	ate exa	mination for the teachin	g degree Mittelschule	Physics (2018)		
First sta	ate exa	mination for the teachin	g degree Grundschule	Physics (2020)	rog data ra	
LA MITTEISC	nuten Phy	SICS (2020)	cord Lehramt Mitt	elschulen (Unterrichtsfach) P	hysik - 2020	page 40 / 71





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

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Thesis (4 ECTS credits)

Students studying for a teaching degree Mittelschule must complete a practical training in didactics and teaching methodology (studienbegleitendes fachdidaktisches Praktikum) which refers to one of the subjects they selected as vertieft studiertes Fach (subject studied with a focus on the scientific discipline) pursuant to Section 34 Subsection 1 No. 4 LPO I (examination regulations for teaching-degree programmes). The obligatory accompanying tutorial is offered by the respective subject. The ECTS credits obtained are counted in the subject Erziehungswissenschaften pursuant to Section 10 Subsection 3 LASPO (general academic and examination regulations for teaching-degree programms).

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		-

Module title					Abbreviation	
Physics: Practical Training and Theory of Classroom					11-L-SBPMS-152-mo1	
Module	coord	inator		Module offered by		
holder	of the (Chair of Physics and its D	idactics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
4	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
The mo cal prac holding sed in a lyse cla sequen transpa dents in	dule in ctice of g classe agreem isses; b ices an arency s n devel	troduces teaching practic Physics by observing and the sthemselves. In the corr ent with the teachers: Int pasics of general school a d models; introduction to sketches. The main focus oping own classes.	ce. The students gain d discussing classes. responding seminar, troduction to the curr and class pedagogics o the usage of moder s will be on class prace	insights into the pe They consolidate th the following topics iculum of Hauptschu ; subject-specific wo n media; developme tice, the correspond	dagogical, didactic and methodi- eir knowledge by preparing and (among others) will be discus- ile; criteria to observe and ana- ork methods; planning of class nt of blackboard pictures and ing seminar also helps the stu-	
Intende	ed learr	ning outcomes				
The stu are able lect and school the orga	dents f e to im d use m pedago anisatio	nave gained deep insight plement the contents of t nedia, methods and socia ogics and learning psycho on of classes.	is into the main steps the 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	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
P (o) + :	S (2)					
Methoo module is	d of ass creditab	s essment (type, scope, langua; le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
term pa Langua	aper (15 ge of a	; to 20 pages) ssessment: German and/	/or English			
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
120 h						
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
§ 34 1	§ 34 1 Nr. 4					
Module	e appea	ars in				
First sta First sta on 201	ate exa ate exa 5))	mination for the teaching mination for the teaching	g degree Mittelschule g degree Mittelschule	Educational Science Educational Science	e (2015) e (2020 (Prüfungsordnungsversi-	

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Extra Skills (ECTS credits)

Teaching degree students must take modules worth a total of 15 ECTS credits in the area Freier Bereich (general as well as subject-specific electives) (Section 9 LASPO (general academic and examination regulations for teaching-degree programmes)). To achieve the required number of ECTS credits, students may take any modules from the areas below.

Freier Bereich -- interdisciplinary: The interdisciplinary additional offer for a teaching degree can be found in the respective Annex "Ergänzende Bestimmungen für den "Freien Bereich" im Rahmen des Studiums für ein Lehramt".

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Physics (ECTS credits)

(Freier Bereich (general as well as subject-specific electives) -- subject specific)

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Module title				Abbreviation		
Teachi	Teaching Seminar Fundamental Principles 11-L-EL1-152-m01					
Module	e coord	inator		Module offered by		
holder	ofthe	Chair of Physics and its	Didactics	Faculty of Physics a	nd Astronomy	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
3	(not) s	successfully completed				
Duratio	on	Module level	Other prerequisites	i		
1 seme	ster	undergraduate				
Conten	Contents					
Physica ceptior sed on pical so	al and i ns and specifi chool e	nterdisciplinary aspect typical learning difficult c contents of physics e xperiments and suitabl	s of selected topics of ties, elementarisation ducation, verbalisation e media.	physics education, c and didactic reconstr n of physical content	orresponding stude ruction of physical c s, possible teaching	nt precon- ontents ba- ; methods, ty-
Intende	ed lear	ning outcomes				
Advano studen Physics	ced, qu t preco s at uni	alitative knowledge of s nceptions and special versity and school rega	school-relevant areas o media on relevant topi rding contents and me	of Physics; knowledg cs; awareness of the thods.	e of common metho differences betweer	ds, typical n teaching
Course	S (type, r	number of weekly contact hours	s, language — if other than Ge	rman)		
S (2)						
Metho module is	d of ass s creditab	sessment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
b) pres c) writt d) oral e) oral Langua	entatic en exan examir examir age of a	n (approx. 45 minutes) mination (approx. 45 m nation of one candidate nation in groups (groups ssessment: German an	or inutes) or each (approx. 15 minu s of 2, approx. 15 minu d/or English	ites) or tes per candidate)		
Allocat	ion of _l	places				
Additio	onal inf	ormation				
Worklo	ad					
90 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulation	ons for teaching-degree progra	ammes)		
§ 22 Nr. 1 h) § 22 Nr. 2 f) § 22 Nr. 3 f)						
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 Mittelschule Physics (2015) First state examination for the teaching degree Mittelschule Physics (2015)						
LA Mittelsc	hulen Phy	rsics (2020)	JMU Würzburg ● g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	. reg. data re- Physik - 2020	page 46 / 71

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 (Middle School) (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 Realschule 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 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)

Module title				Abbreviation		
Selecte	Selected Topics in Physics Didactics 11-L-EL2-152-mo1					
Module	e coord	inator		Module offered by		
chairpe	erson o	f examination committe	e	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
3	(not) s	successfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	Its					
Current	t topics	in physics education.				
Intende	ed lear	ning outcomes				
The stu red kno	idents l owledge	nave knowledge of a cu	rrent subdiscipline of pecific contexts and in	physics education ar nplement it into clas	nd are able to classif ses.	y the acqui-
Course	S (type, r	umber of weekly contact hours	language — if other than Ge	rman)		
S (2)		,	,			
Metho	d of ass	essment (type, scope, langu	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
a) term b) pres c) writte d) oral e) oral Langua	a) term paper (approx. 8 pages) or b) presentation (approx. 45 minutes) or c) written examination (approx. 45 minutes) or d) oral examination of one candidate each (approx. 15 minutes) or e) oral examination in groups (groups of 2, approx. 15 minutes per candidate)					
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
90 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulation	ons for teaching-degree progra	ammes)		
§ 22 § 22 § 22	Nr. 1 h) Nr. 2 f) Nr. 3 f)					
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 Mittelschule Physics (2015) First state examination for the teaching degree Grundschule Didactics in Physics (Middle School) (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 Realschule Physics (2018)						
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 48 / 71

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 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)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data re-	pa
	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Module title				Abbreviation		
MINT Pi	MINT Preparatory Course Mathematical Methods of Physics				11-P-VKM-202-m01	
Module	coord	inator		Module offered by		
Managi the Inst	ng Dire itute o	ectors of the Institute of f Theoretical Physics an	Applied Physics and d Astrophysics	Faculty of Physics a	nd 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 semes	ster	undergraduate				
Content	re l	undergraduite	1			
Mathematical basics and elementary calculus refreshing and extending knowledge from school, especially as an introduction and preparation for the modules of experimental and theoretical physics. 1. Basic geometry and algebra, 2. differential calculus and series, 3. integral calculus, 4. vectors – directional quantities, 5. coordinate systems, 6. complex numbers						
Intende	d learr	ning outcomes				
Student quired f	Students are in command of knowledge of basic mathematics and possess skills in elementary calculus as re- quired for the successful start into the studies of experimental and theoretical physics.					
Courses	5 (type, n	umber of weekly contact hours,	language — if other than Ger	rman)		
V (1) + Ü Module) (2) taugh	t in: German or English				
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)						
a) exerc b) talk (Assessr	ises (s approx	uccessful completion o k. 15 minutes) ffered: Once a year, win	f approx. 50% of approter semester	ox. 6 exercise sheets) or	
Allocati	on of p	olaces				
Additio	nal info	ormation				
Workloa	ad					
90 h						
Teachin	ig cycl	e				
Teachin	g cycle	e: every year, winter sem	nester			
Referre	d to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
§ 22 N § 22 N § 22 N	Nr. 1 h) Nr. 2 f) Nr. 3 f)					
Module	appea	in				
Bachelo	or's deg	gree (1 major) Physics (2	2020)			
Bachelo	or's deg	gree (1 major) Nanostru	cture Technology (202	o)		
Bachelo	pr's de	gree (1 major) Mathema	tical Physics (2020)			
Bachelo	or's deg	gree (1 major, 1 minor) P mination for the teachin	hysics (Minor, 2020)	Didactics in Dhysics	(Driman, School) (a	ooo)
First sta	ite exal	mination for the teachin	is degree Grundschule	Physics (2020)	Grinnary School) (2)	020)
First sta	ite exa	mination for the teaching	g degree Gymnasium	Physics (2020)		
First sta	ite exa	mination for the teachin	g degree Realschule F	Physics (2020)		
First sta	ite exa	mination for the teachin	g degree Sonderpäda	gogik Didactics in Ph	ysics (Middle Schoo	ol) (2020)
LA Mittelsch	ulen Phy	sics (2020)	JMU Würzburg ● go cord Lehramt Mitt	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) P	. reg. data re- hysik - 2020	page 50 / 71





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)

A Mittelschulen Physics (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data re-	page 51 / 71
	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Module title			Abbreviation			
Studen	Student Lab Supervision (Physics) 11-L-L3B-152-m01					
Module coordinator			Module offered by			
holder	of the (Chair of Physics and its D	idactics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
2	(not) s	successfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	Its					
The mo in the t	dule p eachin	rovides an introduction to g-learning-laboratory.	o successful supervis	ion of pupils indepe	ndently carrying out	experiments
Intend	ed lear	ning outcomes	·			
The students learn to classify different groups of pupils according to their subject-specific and experimental level of performance, to support the pupils according to their needs and age and to help them during independent experimenting (supervision competencies in open classroom situations). The students are able to methodically and critically evaluate their own actions. A lecturer gives individual feedback to the students to avoid negative behaviour patterns and to support the students' strengths. The students develop professional behaviour patterns by repeatedly working on the same topic with different groups of pupils (reflection competencies and self-control competencies).						
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
P (2)						
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)						
a) writt b) oral c) oral d) term	en exai examir examin paper	mination (approx. 45 min lation of one candidate e ation in groups (groups c (approx. 8 pages)	utes) or ach (approx. 10 minu of 2, approx. 10 minut	tes) or tes per candidate) or		
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
This m	odule is	s designed for students s	tudying at least one s	subject in the natura	l sciences.	
Worklo	ad		·			
60 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
§ 22 § 22 § 22	Nr. 1 h) Nr. 2 f) Nr. 3 f)					
Module	e appea	ins in				
First sta 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 teaching mination for the teaching sics (2020)	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 enerated 19-Apr-2025 • exam	s (Primary School) (2 nysics (Middle Schoo (Middle School) (20 . reg. data re-	015) 01) (2015) 015) page 52 / 71
	,		cord Lehramt Mitt	elschulen (Unterrichtsfach) P	Physik - 2020	

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 (Middle School) (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 Realschule 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 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 Physics (2020)

A Mittelschulen Physics (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data re-	page 53 / 71
	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Module title					Abbreviation	
Low Co	st - Hig	h Impact. Low-budget	Experiments for Science	e Courses (Phy-	11-MIND-Ph1-152-m	01
sics)	-			· · ·		
Module	coord	inator		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. com	pl. of module(s)	,	
2	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
1 Seme	ster	undergraduate				
Conten	ts					
Concor	tion an	d realisation of overring	nental stations with as	dinany and inovnone	ive consumption for	classos of
Grunds	chule a	and secondary level L	nental Stations With Of	amary and mexpens	ive consumables for	classes OI
Intende	d lear	ning outcomes				
The ctu	dente	lavelon simple scientifi	c experimenting statio	ns to use for the tra	sition from priman	to seconda
rv level	l for sn	nall groups from differe	nt types of schools. In	doing so. they learn	to simplify and conv	vev scientific
content	s relev	ant to the curriculum in	due consideration of t	he target group.		.,
Courses	5 (type, n	umber of weekly contact hours	, language — if other than Ger	man)		
S (2)						
Method	lofass	essment (type, scope, lang	Jage — if other than German	examination offered — if no	t every semester, informati	on on whether
module is	creditab	le for bonus)		in the second se	,,, moniuti	
a) writte	en exar	mination (approx. 45 m	inutes) or			
b) oral (examin	ation of one candidate	each (approx. 10 minu	tes) or		
c) oral e	examin	ation in groups (groups	of 2, approx. 20 minu	tes) or		
d) term	paper	(approx. 8 pages)				
Allocat	ion of p	olaces				
	•••					
Additio	nal info	ormation				
This mo	odule is	s designed for students	studying at least one s	subject in the natura	l sciences.	
Worklo	ad					
60 h						
Teachir	ng cycl	e				
Referre	d to in	LPOI (examination regulation	ons for teaching-degree progra	mmes)		
§ 22 N	Vr. 1 h)					
§ 22 N	vr. 2 f)					
§ 22 N	Vr. 3 f)					
Module	appea	rs in				
First sta	ate exa	mination for the teaching	ng degree Grundschule	Physics (2015)	<u>, , , , , , , , , , , , , , , , , , , </u>	,
First sta	ite exa	mination for the teaching	ng degree Grundschule	Didactics in Physics	5 (Primary School) (2	015)
First sta	ate exa	mination for the teachin	ng degree Kealschule P	nysics (2015)		
First Sta	ite exal	mination for the teaching	ig degree Gymnasium ig degree Sondernädar	rnysics (2015) gogik Didactics in Ph	nysics (Middle Schoo)) (2015)
First sta	ite exa	mination for the teaching	ng degree Mittelschule	Physics (2015)		,, (2015)
First sta	te exa	mination for the teaching	ng degree Mittelschule	Didactics in Physics	(Middle School) (20	015)
First sta	ate exa	mination for the teaching	ng degree Grundschule	Physics (2018)		<i>ر</i> ر - ۰
First sta	ate exa	mination for the teaching	ng degree Grundschule	Didactics in Physics	s (Primary School) (2	018)
First sta	ate exa	mination for the teaching	ng degree Realschule P	hysics (2018)	(, coco.) (L	
LA Mittelsch	ulen Phy	sics (2020)	 JMU Würzburg ● ge	enerated 19-Apr-2025 • exam	. reg. data re-	page 54 / 71
			cord Lehramt Mitt	elschulen (Unterrichtsfach) P	Physik - 2020	

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 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)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data re-	p
	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Module title				Abbreviation		
Teachi	Teaching Science with Hands-on-Exhibits (Physics) 11-MIND-Ph2-152-m01				01	
Module	Module coordinator			Module offered by		
holder	ofthe	Chair of Physics and its	Didactics	Faculty of Physics a	nd Astronomy	
ECTS	Meth	od of grading	Only after succ. con	pl. of module(s)		
2	(not)	successfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	Its					
Design	ing and	l creating hands-on exh		5.		
Intend	ed lear	ning outcomes				
The stu tents ir ject-ori	The students evaluate the advantages and disadvantages of the hands-on approach for teaching scientific con- tents in and out of school. They plan and implement an interdisciplinary science exhibition as an example of pro- ject-oriented work with pupils of secondary level I and II.					
Course	S (type, r	number of weekly contact hours,	, language — if other than Ger	man)		
S (2)						
Metho module is	d of ass s creditab	sessment (type, scope, langu le for bonus)	age — if other than German, o	examination offered — if no	t every semester, informati	on on whether
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)						
Allocat	ion of _l	olaces				
Additio	onal inf	ormation				
This m	odule i	s designed for students	studying at least one	subject in the natura	l sciences.	
Worklo	ad					
60 h						
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
§ 22	Nr. 1 h)					
§ 22 8 22	Nr. 2 f)					
9 22 11	INT. 31)	···· •				
Module	e appea	ars in mination for the too shire				
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 Physics (2015)						
First sta First sta First sta First sta	ate exa ate exa ate exa ate exa	mination for the teachir mination for the teachir mination for the teachir mination for the teachir	ng degree Grundschule ng degree Grundschule ng degree Realschule F ng degree Gymnasium	Physics (2018) Didactics in Physics Physics (2018) Physics (2018)	s (Primary School) (2	018)
LA Mittelsc	hulen Phy	sics (2020)	JMU Würzburg • go cord Lehramt Mitt	enerated 19-Apr-2025 • exam elschulen (Unterrichtsfach) P	. reg. data re- Physik - 2020	page 56 / 71

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 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)

Module title			Abbreviation			
Astrophysics 11-A				11-AP-152-m01		
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire trophys	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	numei	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	undergraduate				
Conten	ts					
History of astronomy, coordinates and time measurement, the Solar System, exoplanets, astronomical scales, telescopes and detectors, stellar structure and atmospheres, stellar evolution and end stages, interstellar medi- um, molecular clouds, structure of the milky way, the local universe, the expanding universe, galaxies, active ga- lactic nuclei, large-scale structures, cosmology.						
Intende	ed learr	ning outcomes				
The stu physica ons. Th laxies.	dents a al obse ey are f	are familiar with the mo rvations and evaluation familiar with the physio	odern world view of Ast ns. They are able to use cs 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	s for astro- n observati- stars and ga-
Courses	S (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
V (2) + I Module	R (2) taugh	t in: German or English				
Method	l of ass	s essment (type, scope, lang	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
module is	creditab	le for bonus)				
 a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. 					nt may in- If the method riginal exami-	
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
180 h						
Teachir	ng cyclo	9				
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	mmes)		
§ 22 N § 22 N § 22 N	Nr. 1 h) Nr. 2 f) Nr. 3 f)					
Module	appea	in and a second se				
LA Mittelsch	nulen Phys	sics (2020)	JMU Würzburg • g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	. reg. data re- Physik - 2020	page 58 / 71

UNIVERSITÄT WÜRZBURG



Bachelor's degree (1 major) Physics (2015) 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	e title				Abbreviation	
Princip	les of E	nergy Technologies			11-ENT-152-m01	
Module	Module coordinator			Module offered by		
Manag	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	its					
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						
Intend	ed learr	ning outcomes				
The students know the principles of different methods of energy technology, especially energy conversion, transport and storage. They understand the structures of corresponding installations and are able to compare them.						
Course	S (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
V (3) + Module	R (1) e taugh	t in: German or English				
Metho	d of ass	essment (type, scope, lang	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
module is	s creditab	le for bonus)				
 b) oral c) oral d) projection e) pressified a write stead t of assest of assest o	examin examin ect repo entatio tten exa ake the essment date at age of a	ation of one candidate ation in groups (group ort (approx. 8 to 10 pag n/talk (approx. 30 min mination was chosen form of an oral examin t is changed, the lectur the latest. ssessment: German ar ffered: Once a year. wi	e each (approx. 30 minu s of 2, approx. 30 minu es) or utes) as method of assessm nation of one candidate er must inform student nd/or English nter semester	utes) or tes per candidate) of ent, this may be char e each or an oral exa is about this by four	r nged and assessmei mination in groups. weeks prior to the oi	nt may in- If the method riginal exami-
Allocat	tion of p	laces				
Additio	onal info	ormation				
Worklo	ad					
180 h						
Teachi	ng cycl	9				
Referre	ed to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)		
§ 22 § 22 § 22	Nr. 1 h) Nr. 2 f) Nr. 3 f)					
Module	e appea	rs in				
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 60 / 71
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Bachelor's degree (1 major) Physics (2015) 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	
Current Topics of Teaching Concepts in Physics 11-L-APD-152-				11-L-APD-152-m01	
Modul	e coordinator		Module offered by		
chairpe	erson of examination committe	e	Faculty of Physics a	nd Astronomy	
ECTS	Method of grading	Only after succ. con	npl. of module(s)		
3	numerical grade				
Duratio	on Module level	Other prerequisites			
1 seme	ster undergraduate				
Conter	its				
Curren	t topics in physics education.				
Intend	ed learning outcomes				
The stu red kno	idents have knowledge of a cu owledge according to subject-s	rrent subdiscipline of p pecific contexts and ir	physics education ar nplement it into clas	nd are able to classif ses.	y the acqui-
Course	S (type, number of weekly contact hours	, language — if other than Ger	rman)		
S (2) Module	e taught in: German or English				
Metho module i	d of assessment (type, scope, langu s creditable for bonus)	age — if other than German, o	examination offered — if no	t every semester, informati	on on whether
a) writt b) oral c) oral d) term e) talk	en examination (approx. 45 mi examination of one candidate examination in groups (groups paper (approx. 8 pages) or (30 to 45 minutes) with discuss	nutes) or each (approx. 10 minu of 2, approx. 10 minu sion	ites) or tes per candidate) or		
Allocat	ion of places				
Additio	onal information				
		_			
Worklo	ad				
90 h					
Teachi	ng cycle				
Referre	ed to in LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
§ 22	Nr. 1 h)				
§ 22 § 22	Nr. 3 f)				
Modul	e appears in				
First st	ate examination for the teachir	ng degree Grundschule	Physics (2015)		
First st	ate examination for the teachir	ig degree Grundschule	Didactics in Physics	6 (Primary School) (2	015)
First st	ate examination for the teachir	ig degree Realschule F	hysics (2015)		
First st	ate examination for the teachir	ng degree Gymnasium	Physics (2015)		
First st	ate examination for the teachir	ig degree Sonderpäda	gogik Didactics in Ph	iysics (Middle Schoo	DI) (2015)
First st	ate examination for the teachir	is degree Mittelschule	Didactics in Physics	(Middle School) (20	015)
First st	ate examination for the teachir	ig degree Grundschule	Physics (2018)		/(- ·
First st	ate examination for the teachir	ig degree Grundschule	Didactics in Physics	s (Primary School) (2	018)
First st	ate examination for the teachir	ng degree Realschule F	Physics (2018)		
LA Mittelso	hulen Physics (2020)	JMU Würzburg ● g cord Lehramt Miti	enerated 19-Apr-2025 • exam elschulen (Unterrichtsfach) P	. reg. data re- hysik - 2020	page 62 / 71

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 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	
Scientific Work in Teaching Concepts 11-L-WPD-152-mo1						
Module coordinator			Module offered by			
Managing Director of the Institute of Applie		Applied Physics	Faculty of Physics a	nd Astronomy		
ECTS Method of grading Only after succ. compl. of module(s)						
3	(not) s	uccessfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Current	t topics	in scientific work in ph	vsics education			
Intende	ed learr	ing outcomes	<u>,</u>			
The stu of phys	idents h sics edu	nave knowledge of a cu cation on the basis of	rrent subdiscipline of p scientific methods.	physics education ar	id are able to proces	s questions
Course	S (type, n	umber of weekly contact hours	 . language — if other than Ger	rman)		
S (2) Module	e taught	in: German or English				
Methoo module is	d of ass	essment (type, scope, lang	uage — if other than German, e	examination offered — if no	t every semester, informati	on on whether
talk (30	0 to 45 r	ninutes)				
Allocat	ion of n	laces				
Additio	nal info	ormation				
Additio						
Worklo	ad					
oo h						
Teachi						
	is cycu	•				
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)		
§ 22	Nr. 1 h)					
§ 22 II Nr. 2 f)						
§ 22 Nr. 3 f)						
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 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)						
LA Mittelsc	hulen Phys	sics (2020)	JMU Würzburg • ge cord Lehramt Mitt	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) P	. reg. data re- 'hysik - 2020	page 64 / 71

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

Module title					Abbreviation	
Current Topics in Physics 11-LX6-152-m01						
Module coordinator			Module offered by			
chairp	erson of	f examination committe	e	Faculty of Physics a	nd Astronomy	
ECTS Method of grading Only after succ. compl. of module(s)						
6	nume	rical grade				
Durati		Madula laval	Other prorequisites			
Duratio				• .• •	• •	
1 seme	ester	undergraduate	Approval from exam	ination committee re	equired.	
Conter	115					
Curren	t topics	in physics.				
Intend	ed learr	ning outcomes				
The stu lation know t	udents H method he appl	nave knowledge of a cu s necessary to acquire ication areas.	rrent subdiscipline of I this knowledge. They a	Physics and understa are able to classify th	and the measuring a e subject-specific co	nd/or calcu- ontexts and
Course	es (type, n	umber of weekly contact hours	s, language — if other than Gei	rman)		
V (3) +	R (1)					
Metho module i	d of ass s creditab	e essment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
 c) oral examination of one candidate each (approx. 30 minutes) of c) oral examination in groups (groups of 2, approx. 30 minutes) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English 						
Additional information						
Workload						
180 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
§ 22 Nr. 1 h)						
§ 22 Nr. 2 f)						
§ 22 II Nr. 3 f)						
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 st	ate exa	mination for the teachi	ng degree Sonderpäda	gogik Didactics in Pl	nysics (Middle Schoo	ol) (2015)
First state examination for the teaching degree Mittelschule Physics (2015)						
LA Mittelso	chulen Phy	sics (2020)	JMU Würzburg • g cord Lehramt Mit	enerated 19-Apr-2025 • exam telschulen (Unterrichtsfach) F	. reg. data re- Physik - 2020	page 66 / 71

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 (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 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 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 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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	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Module title					Abbreviation	
Selected Topics of Physics 11-LCS6-152-m01						
Module coordinator				Module offered by		
chairpe	erson o	f examination committe	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	Its					
Current study a	t topics abroad.	in experimental physic	cs. Credited academic	achievements, e.g. ir	ι case of change of ι	iniversity or
Intend	ed lear	ning outcomes				
The stu sics of unders classify	idents l the Bao tand th y the su	have advanced compet chelor's programme. Th e measuring and/or ev bject-specific contexts	encies corresponding bey have knowledge of caluation methods nece and know the applicat	to the requirements of a current subdiscipli essary to acquire this tion areas.	of a module of Exper ne of Experimental I s knowledge. They a	imental Phy- Physics and re able to
Course	S (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V (2) +	R (1)					
Metho module is	d of ass s creditab	sessment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
 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	ion of p	olaces				
Additional information						
Workload						
120 h						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
§ 22 Nr. 1 h) § 22 Nr. 2 f) § 22 Nr. 3 f)						
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)						
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 68 / 71

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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) 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)





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.

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	cord Lehramt Mittelschulen (Unterrichtsfach) Physik - 2020	

Module title					Abbreviation
Thesis	Thesis in Physics Secondary General School 11-L-HA-MS-UF-152-mo1				
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			
Duration Module level		Other prerequisites			
1-2 sem	nester	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 due co	dents a ethods nsidera	are able to independently acquired in the teaching ition of didactic aspects.	/ 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
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
No cou	rses as	signed to module			
Method module is	d of ass creditab	essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
Hausarbeit (thesis) pursuant to Section 29 LPO I (examination regulations for teaching-degree programmes) (ap- prox. 40 pages) Language of assessment: German; exceptions pursuant to Section 29 Subsection 4 LPO I (examination regulati- ons for teaching-degree programmes)					
Allocation of places					
Additio	nal inf	ormation			
Workload					
300 h					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
§ 29					
Module appears in					
First sta First sta	First state examination for the teaching degree Mittelschule Physics (2015) First state examination for the teaching degree Mittelschule Physics (2018)				
First state examination for the teaching degree Mittelschule Physics (2020)					