

Subdivided Module Catalogue for the Subject

Physics

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

Examination regulations version: 2008 Responsible: Faculty of Physics and Astronomy



Course of Studies - Contents and Objectives

The goal of the studies is it to mediate knowledge on the most important subsections of physics and to make the students familiar with the methods of physical scientific and physical thinking and working. By training of analytic thinking abilities the students acquire the ability to deal later with the various fields of applications and to compile the basic knowledge in particular necessary for a consecutive Bachelor and Master course of studies. Therefore the main emphasis is put on the understanding of the fundamental experimental and theoretical physical terms and laws as well as on basic scientific methods and the development of the typical scientific thinking and working structures. During the Bachelor thesis the student should work on a thematic and temporally limited experimental or theoretical engineering-scientific task in the field of experimental or theoretical physics using well-known procedures and scientific criteria under guidance to a large extent independently.



Abbreviations used

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

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:

ASP02007

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

3-Sep-2009 (2009-29)

This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.



The subject is divided into

Abbreviation		Module title	ECTS credits	Method of grading	page	
Compulsory Courses (14	o ECTS credi	ts)				
Experimental Physics (46 ECTS credits)						
11-E1-072-m01	Experimentand Oscilla	tal Physics 1 (Mechanics, Thermodynamics, Waves ations)	8	NUM	15	
11-E2-072-m01	Experimen	tal Physics 2 (Electrics and Magnetism)	8	NUM	16	
11-E3-072-m01		tal Physics 3 (Optics, Quantum Phenomena, Intro- omic Physics)	8	NUM	17	
11-E6-072-m01	Nuclear an	d Elementary Particle Physics	4	NUM	20	
11-E7-072-m01	1 '	tal Physics 7 (Solid State Phenomena [Semiconduc-onductivity, Magnetism])	4	NUM	21	
11-E5-082-m01	Experimen	tal Physics 5 (Introduction to Solid State Physics)	8	NUM	19	
11-E4-082-m01	Experimen	tal Physics 4 (Physics of Atoms and Molecules)	6	NUM	18	
Theoretical Physics (32	ECTS credit	rs)				
11-T1-072-m01	Theoretica	Physics 1 (Theoretical Mechanics)	8	NUM	38	
11-T2-072-m01	Theoretical namics)	Physics 2 (Theoretical Electrostatics and Elektrody-	8	NUM	39	
11-T3-072-m01	Theoretica	Physics 3 (Theoretical Quantum Mechanics)	8	NUM	40	
11-T3F-072-m01	Theorectica nics)	al Physics 3 FOKUS (Theoretical Quantum Mecha-	8	NUM	41	
11-T4-072-m01	Theorectica stics)	al Physics 4 (Theoretical Thermodynamics and Stati-	8	NUM	42	
Lab Course Physics (16 ECTS credits)						
11-PGA-PGR-072-m01	Basic Pract	cical Course B for Students of Physics (Bachelor of d Teaching Degree)	6	B/NB	35	
11-PGB-PGN-072-m01	1	Undergraduate Laboratory (Atomic Physics, Nuclear	4	B/NB	36	
11-PFB-072-m01	Advanced	Practical Course Bachelor	4	B/NB	22	
11-PHS-072-m01	Main Semi	nar Experimental / Theoretical Physics	2	NUM	25	
Mathematics (34 ECTS	credits)					
11-MPI3-062-m01	Mathemati	cs 3 for students of Physics and Engineering	8	NUM	29	
10-M-PHY1-072-m01	Mathemati	cs for Physicists 1	10	NUM	27	
10-M-PHY2-072-m01	Mathemati	cs for Physicists 2	8	NUM	28	
11-MPI4-062-m01	Mathemati	cs 4 for Students of Physics and Engineering	8	NUM	30	
Module Comprehensive	Tests (12 E	CTS credits)				
11-PREP-072-m01	Oral Exam	Experimental Physics (Physicists)	6	NUM	31	
11-PRT-072-m01	Oral Exam	Theoretical Physics	6	NUM	32	
Compulsory Electives (10	ECTS credi	ts)				
Chemistry (10 ECTS cre	dits)					
08-CP1-072-m01	General Ch	emistry for Physics and Engineers	10	NUM	9	
Computer Science (10 E	CTS credits				•	
10-I-EIN-072-m01	Introductio	n to Computer Science for Students of all Faculties	10	NUM	12	
Numerical Mathematic	s (10 ECTS cı	redits)			•	
10 M ODE 000 most	Ordinary D	ifferential Equations	5	NUM	23	
10-M-ODE-082-m01	Jordinary D					



10-M-NM1-082-m01	Numerical Mathematics 1	8	NUM	33				
10-M-NM2-082-m01	10-M-NM2-082-m01 Numerical Mathematics 2		NUM	34				
10-M-PRG-082-mo1 Programming course for students of Mathematics and other subjects		3	B/NB	37				
10-M-COM-082-m01	Computeroriented Mathematics	3	B/NB	11				
Thesis (10 ECTS credits)	Thesis (10 ECTS credits)							
11-BA-P-072-m01	Bachelor Thesis Physics	10	NUM	8				
Subject-specific Key Skills (14 ECTS credits)								
11-PFR-072-m01	Measurements and Data Analysis	2	NUM	7				
11-A1-072-m01	Computational Physics	6	NUM	10				
11-A3-072-m01	Laboratory and Measurement Technology	6	NUM	26				
11-A4-072-m01	Astrophysics	6	NUM	6				
11-N1-072-m01	Basics of NanostructureTechnology	6	NUM	24				
11-A2-081-m01	Electronics	6	NUM	14				
11-MKS-082-m01	Introduction Course Mathematics	3	B/NB	13				



Module	title				Abbreviation	
Astroph	nysics				11-A4-072-m01	
Module	coord	inator		Module offered by		
Managi and Ast	_	ector of the Institute of Tl sics	neoretical Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. cor	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites	Other prerequisites		
1 seme	ster	undergraduate	Admission prerequisites to assessment: successful completion of apprenticular presequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course we be considered a declaration of will to seek admission to assessment. Students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.			
Conten	ts					

History of astronomy, coordinates and time measurement, the solar system, size scales in outer space, telescopes and detectors, stellar structure, stellar atmospheres, stellar evolution, final stages of stellar evolution, interstellar medium, structure of the Milky Way, local universe, expanding space-time, galaxies, active galactic nuclei, large-scale structure of the universe, Friedmann World Models, thermodynamics of the early universe, primordial nucleosynthesis, cosmic microwave background radiation, structure formation, inflation

Intended learning outcomes

The students are familiar with the modern world view of Astrophysics. They know methods and tools for astrophysical observations and evaluations. They are able to use these methods to plan and analyse own observations. They know the structure of the universe, e.g. of stars and galaxies and understand the process of their development.

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

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

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

written examination (approx. 120 minutes)

Allocation of places

Only as part of pool of general key skills (ASQ): 15 places. Places will be allocated by lot.

Additional information

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



Modul	Module title Abbreviation						
Measu	rement	s and Data Analysis		11-PFR-072-m01			
Module coordinator Module offered by							
Manag	ging Dir	ector of the Institute of A	pplied Physics	Faculty of Physics a	and Astronomy		
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)			
2	nume	rical grade					
Durati	on	Module level	Other prerequisites				
1 seme	ester	undergraduate					
Conte	nts						
		, error approximation an bution functions, signific			average values and standard de- lications.		
Intend	led lear	ning outcomes					
		e, the students acquire s error propagation and th			ave knowledge of practical experi-		
Course	es (type	, number of weekly cont	act hours, language –	- if other than Germa	ın)		
V + Ü (no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)		
		sessment (type, scope, l			ition offered — if not every seme-		
writter	written examination (approx. 120 minutes)						
Allocation of places							
Additional information							
Referr	ed to in	LPO I (examination regi	ulations for teaching-	degree programmes)			
Referred to in LPO I (examination regulations for teaching-degree programmes)							



			Abbreviation			
achelor Thesis Physics			11-BA-P-072-m01			
odule coordinator		Module offered by				
nairperson of examination committ	tee	Faculty of Physics a	and Astronomy			
TS Method of grading	Only after succ. cor	npl. of module(s)				
numerical grade						
uration Module level	Other prerequisites	i				
semester undergraduate						
ontents						
ostly independent processing of a nd scientific aspects.	n experimental or theo	retical task of Physic	s according to known procedures			
tended learning outcomes						
ne students are able to independen ording to known methods and scie						
ourses (type, number of weekly co	ntact hours, language -	– if other than Germa	an)			
courses assigned						
ethod of assessment (type, scope er, information on whether module			ation offered — if not every seme-			
ritten thesis (approx. 25 pages) Inguage of assessment: German o	r English					
Allocation of places						
Additional information						
eferred to in LPO I (examination re		degree nrogrammes				



Module title					Abbreviation
General Chemistry for Physics and Engineers			d Engineers		08-CP1-072-m01
Module coordinator				Module offered by	
lecturer of the course Institute of Inorganic			ic Chemistry		
ECTS	Meth	od of grading	Only after succ. co	mpl. of module(s)	
10	nume	rical grade			
Duration Module level Other prerequisites			Other prerequisites	5	
1 semester undergraduate					
Contents					

This module discusses the fundamental principles of both inorganic and organic chemistry. The lab course gives students the opportunity to learn essential methods and perform simple experiments.

Intended learning outcomes

Students are able to explain the principles of the periodic table and to extract information from it. They are able to explain basic models of the structure of matter. They have developed the ability to use the language of chemical formulas to describe chemical reactions and to interpret them by identifying the type of reaction. They are able to identify fundamental problems in chemistry and perform experiments to solve them.

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

This module comprises 3 module components. Information on courses will be listed separately for each module component.

- 08-IOC-1-072: V (no information on SWS (weekly contact hours) and course language available)
- 08-CP1-1-072: V (no information on SWS (weekly contact hours) and course language available)
- 08-CP1-3-072: P (no information on SWS (weekly contact hours) and course language available)

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

Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

Assessment in module component o8-IOC-1-072: Organic Chemistry for students of medicine, biomedicine, dental medicine, engineering and natural science

- 3 ECTS, Method of grading: numerical grade
- written examination (approx. 60 minutes)

Assessment in module component o8-CP1-1-072: Basics of General an Inorganic Chemistry

- 5 ECTS, Method of grading: numerical grade
- written examination (60 minutes)

Assessment in module component o8-CP1-3-072: General and Analytical Chemistry (lab)

- 2 ECTS, Method of grading: (not) successfully completed
- for each experiment: Vortestate (pre-experiment exams, approx. 10 minutes each), assessment of practical performance (log, 2 to 5 pages), Nachtestate (post-experiment exams, approx. 10 minutes each)
- Assessment offered: once a year, summer semester
- Only after successful completion of module components: Successful completion of module component o8-CP1-1 is a prerequisite for participation in module component o8-CP1-3.

Allocation of places
Additional information
Referred to in LPO I (examination regulations for teaching-degree programmes)



Modul	Module title Abbreviation					
		al Physics			11-A1-072-m01	
Modul	e coord	inator		Module offered by		
	ging Dire	ector of the Institute of Tl sics	neoretical Physics	Faculty of Physics a	and Astronomy	
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)		
6	nume	rical grade				
Durati	on	Module level	Other prerequisites	;		
1 seme	ester	undergraduate				
Conte	nts					
		o two of the programmin s with computer program		for students of Phys	ics and Engineering, solving phy-	
Intend	led lear	ning outcomes				
		have acquired the follow ng with computers, knov			of two programming languages, vsical problems.	
Course	es (type	, number of weekly conta	act hours, language -	- if other than Germa	an)	
V + Ü ((no info	rmation on SWS (weekly	contact hours) and c	ourse language avail	lable)	
		sessment (type, scope, la ion on whether module c			ation offered — if not every seme-	
writter	n exami	nation (approx. 120 minu	ites)			
Allocation of places						
Additio	Additional information					
Referr	Referred to in LPO I (examination regulations for teaching-degree programmes)					



Module	e title				Abbreviation	
		nted Mathematics			10-M-COM-082-m01	
Module	coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
3	(not)	successfully completed				
Duratio	n	Module level	Other prerequisites	i		
1 seme	ster	undergraduate	1		regular attendance of exercises one incident of unexcused ab-	
Conten	ts					
merica 10-M-A lar diffe	l compo NL) and erential ed lear	utation (e.g. Matlab) to s d 10-M-LNA). Computer-b l and integral calculus; vi ning outcomes	upplement the basic ased solution of prob sualisation of functio	modules in analysis blems in linear algeb ons.	Mathematica or Maple) and nuss and linear algebra ((10-M-ANA or ora, geometry, analysis, in particu-	
		earns the use of advanced cation to solve mathema		cal software package	es, and is able to assess their	
Course	s (type	, number of weekly conta	ict hours, language –	- if other than Germa	an)	
V + Ü (ı	no infoi	rmation on SWS (weekly	contact hours) and co	ourse language avail	lable)	
		sessment (type, scope, la ion on whether module c			ation offered — if not every seme-	
Assess	ment o	form of programming exe ffered: once a year, sum ssessment: German, Eng	mer semester		he course)	
Allocation of places						
Additio	nal inf	ormation				

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

§ 73 (1) 5. Mathematik Angewandte Mathematik



Modul	e title				Abbreviation	
Introd	uction t	o Computer Science fo	r Students of all Facult	ies	10-I-EIN-072-m01	
Modul	le coord	linator		Module offered by		
Dean o	of Studi	es Informatik (Compute	er Science)	Institute of Compu	ter Science	
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)		
10	nume	rical grade				
Durati	on	Module level	Other prerequisites	;		
1 seme	ester	undergraduate			academic requirements to be met	
			in exercises as spe	cified at the beginning	ng of the course.	
Conte	nts					
		of computer science inc hms and data structure			vebsites (HTML, XML, EBNF), data-	
Intend	led lear	ning outcomes				
					e areas of representation of infortures, programming in Java.	
Course	es (type	, number of weekly cor	ntact hours, language -	- if other than Germa	an)	
V + Ü +	+ Ü (no	information on SWS (w	eekly contact hours) ar	nd course language a	available)	
		sessment (type, scope, ion on whether module			ation offered — if not every seme-	
-		mination (approx. 90 m nination in groups (gro			idate each (approx. 20 minutes) tes)	
Allocation of places						
Additional information						
	_					
Referre	ed to in	LPO I (examination re	oulations for teaching.	degree nrogrammes)	
ciciii	<u> </u>	LI O I (CAUIIIII ation IC,	5atations for teaching	active programmes)	



Introduction Course Mathematics Module coordinator Managing Director of the Institute of Applied Physics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) (not) successfully completed Duration Module level 1 semester undergraduate Contents Principles of mathematics and basic calculation methods beyond the school curriculum, especially for the introduction to and preparation of the modules of Theoretical Physics and Experimental Physics. Intended learning outcomes The students have knowledge of the principles of mathematics and elementary calculation methods which are required in Theoretical and Experimental Physics. Courses (type, number of weekly contact hours, language — if other than German) V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places Additional information	Modul	Module title Abbreviation						
Managing Director of the Institute of Applied Physics Faculty of Physics and Astronomy ECTS Method of grading (not) successfully completed (not) successfully for the introduction to and preparation of the modules of Theoretical Physics and Experimental Physics. Intended learning outcomes The students have knowledge of the principles of mathematics and elementary calculation methods which are required in Theoretical and Experimental Physics. Courses (type, number of weekly contact hours, language — if other than German) V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places	Introd	ıction (Course Mathematics		11-MKS-082-m01			
ECTS Method of grading Only after succ. compl. of module(s) 3 (not) successfully completed	Modul	e coord	inator	Module offered by				
The students have knowledge of the principles of mathematics and Experimental Physics. The students have knowledge of the principles of mathematics and Experimental Physics. The students have knowledge of the principles of mathematics and elementary calculation methods which are required in Theoretical and Experimental Physics. Courses (type, number of weekly contact hours, language — if other than German)	Manag	ing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	and Astronomy		
Duration Module level undergraduate Contents Principles of mathematics and basic calculation methods beyond the school curriculum, especially for the introduction to and preparation of the modules of Theoretical Physics and Experimental Physics. Intended learning outcomes The students have knowledge of the principles of mathematics and elementary calculation methods which are required in Theoretical and Experimental Physics. Courses (type, number of weekly contact hours, language — if other than German) V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places	ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)			
Contents Principles of mathematics and basic calculation methods beyond the school curriculum, especially for the introduction to and preparation of the modules of Theoretical Physics and Experimental Physics. Intended learning outcomes The students have knowledge of the principles of mathematics and elementary calculation methods which are required in Theoretical and Experimental Physics. Courses (type, number of weekly contact hours, language — if other than German) V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places	3	(not)	successfully completed					
Principles of mathematics and basic calculation methods beyond the school curriculum, especially for the introduction to and preparation of the modules of Theoretical Physics and Experimental Physics. Intended learning outcomes The students have knowledge of the principles of mathematics and elementary calculation methods which are required in Theoretical and Experimental Physics. Courses (type, number of weekly contact hours, language — if other than German) V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places	Duratio	on	Module level	Other prerequisites				
Principles of mathematics and basic calculation methods beyond the school curriculum, especially for the introduction to and preparation of the modules of Theoretical Physics and Experimental Physics. Intended learning outcomes The students have knowledge of the principles of mathematics and elementary calculation methods which are required in Theoretical and Experimental Physics. Courses (type, number of weekly contact hours, language — if other than German) V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places	1 seme	ster	undergraduate					
duction to and preparation of the modules of Theoretical Physics and Experimental Physics. Intended learning outcomes The students have knowledge of the principles of mathematics and elementary calculation methods which are required in Theoretical and Experimental Physics. Courses (type, number of weekly contact hours, language — if other than German) V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places	Conter	ıts						
The students have knowledge of the principles of mathematics and elementary calculation methods which are required in Theoretical and Experimental Physics. Courses (type, number of weekly contact hours, language — if other than German) V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places								
required in Theoretical and Experimental Physics. Courses (type, number of weekly contact hours, language — if other than German) V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places	Intend	ed lear	ning outcomes					
V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places					tics and elementary	calculation methods which are		
Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places	Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	nn)		
ster, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes) Allocation of places	V (no i	nforma	tion on SWS (weekly cont	act hours) and cours	e language available	e)		
Allocation of places						tion offered — if not every seme-		
	written	written examination (approx. 120 minutes)						
Additional information	Allocation of places							
Additional information								
	Additional information							
Referred to in LPO I (examination regulations for teaching-degree programmes)	Referre	ed to in	LPOI (examination regu	lations for teaching-	degree programmes)			



Modul	Module title Abbreviation					
Electronics					11-A2-081-m01	
Module coordinator Module offered by						
Manag	ing Dir	ector of the Institute of A	pplied Physics	Faculty of Physics a	and Astronomy	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ester	undergraduate				
Conter	ıts					
Princip techno		passive and active electron	onic components and	their application in	analogous and digital circuit	
Intend	ed lear	ning outcomes				
	udents techno		ractical setup of elect	ronic circuits from th	ne field of analogous and digital	
Course	es (type	, number of weekly conta	act hours, language –	- if other than Germa	ın)	
V + Ü (no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		sessment (type, scope, laion on whether module c			tion offered — if not every seme-	
written	written examination (approx. 90 minutes)					
Allocation of places						
Additional information						
Roforra	ed to in	IPOI (examination regu	lations for teaching.	degree programmes)		
Referred to in LPO I (examination regulations for teaching-degree programmes)						



Modul	Module title Abbreviation					
Experi	Experimental Physics 1 (Mechanics, Thermodynamics, Waves and Oscillati-					
ons)					,	
Modul	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ıts					
Physic	al laws	of mechanics, vibrations	and waves, thermod	ynamics		
Intend	ed learı	ning outcomes				
The stu	udents i	understand the basic cor	texts and principles	of mechanics, vibrat	ion, waves and thermodynamics.	
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	an)	
V + Ü (no infor	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		sessment (type, scope, lation on whether module c			ation offered — if not every seme-	
written	exami	nation (approx. 120 minu	tes)			
Allocat	Allocation of places					
Additional information						
						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					



Module	e title			Abbreviation		
Experi	mental	Physics 2 (Electrics and		11-E2-072-m01		
Modul	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conter	ıts					
Physic	al laws	of the science of electric	ity, magnetism, elect	romagnetic vibration	is and waves	
Intend	ed learı	ning outcomes				
		understand the basic co I waves.	ntexts and principles	of science of electric	ity, magnetism, electromagnetic	
Course	s (type	, number of weekly cont	act hours, language –	- if other than Germa	n)	
V + Ü (no infor	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		sessment (type, scope, l			tion offered — if not every seme-	
written	exami	nation (approx. 120 mini	utes)			
Allocat	ion of p	olaces				
Additional information						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					



			Abbreviation			
Experimental Physics 3 (Optics, Quantum Phenomena, Introduction Atomic 11-E3-072-m01						
Physics)						
Module coordinator		Module offered by				
Managing Director of the Institute of A	Applied Physics	Faculty of Physics a	and Astronomy			
CTS Method of grading	Only after succ. con	npl. of module(s)				
numerical grade						
Ouration Module level	Other prerequisites					
semester undergraduate						
Contents						
Physical laws of optics, quantum phe	nomena, introduction	to Atomic Physics.				
ntended learning outcomes		·				
he students have knowledge of the l	pasic contexts and pri	nciples of optics, qu	antum phenomena and Atomic			
Courses (type, number of weekly con	tact hours, language –	- if other than Germa	ın)			
+ Ü (no information on SWS (weekly	contact hours) and co	ourse language avail	able)			
Method of assessment (type, scope, ter, information on whether module			ntion offered — if not every seme-			
vritten examination (approx. 120 min	utes)					
Allocation of places						
Additional information						
Referred to in LPO I (examination reg	ulations for teaching-	degree programmes	_			



Module title					Abbreviation	
Experi	mental	Physics 4 (Physics of A		11-E4-082-m01		
Modul	e coord	inator		Module offered by		
Manag	ging Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Durati	on	Module level	Other prerequisites	i		
1 seme	ester	undergraduate				
Conte	nts					
Physic	al laws	of Atomic and Molecula	ar Physics.			
Intend	led lear	ning outcomes				
Quant well as	um med s molec	hanical atom model, o	ne/multi-electron atom and elementary excitati	ns, electronic dipole ons: rotations, vibra	d Molecular Physics (atoms: transitions, atoms in B field as ations, electronic excitations)	
		rmation on SWS (weekl			·	
Metho ster, ir	od of ass		language — if other th can be chosen to earn	an German, examina	ation offered — if not every seme-	
	tion of p		14(03)			
		Juces				
۸۵۵:۰:	onal inf	ormation				
Additional information						
		IDOL (: .:				
Referr	ed to in	LPO I (examination reg	gulations for teaching-	degree programmes)		



Modul	Module title Abbreviation					
Experimental Physics 5 (Introduction to Solid State Physics) 11-E5-082-m01						
Modul	e coord	inator		Module offered by		
Manag	ging Dire	ector of the Institute of A	Applied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Durati	on	Module level	Other prerequisites	i		
1 seme	ester	undergraduate				
Conte	nts					
		of solids: Bonding and lectron gas)	structure, lattice dyna	mics, thermal prope	rties, principles of electronic pro-	
Intend	ed lear	ning outcomes				
		have knowledge of the l properties, principles o	,	•	nding and structure, lattice dyna-	
Course	es (type	, number of weekly con	tact hours, language –	- if other than Germa	an)	
V + Ü (no info	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		sessment (type, scope, on on whether module			ation offered — if not every seme-	
writter	exami	nation (approx. 120 min	utes)			
Alloca	tion of p	olaces				
Additio	onal inf	ormation				
Referre	ed to in	LPO I (examination reg	gulations for teaching-	degree programmes)		



Module title					Abbreviation
Nuclear and Elementary Particle Physics					11-E6-072-m01
Modul	Module coordinator Module			Module offered by	
Manag	ing Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	and Astronomy
ECTS		od of grading	Only after succ. cor	npl. of module(s)	
4	nume	rical grade			
Duratio	on	Module level	Other prerequisites	i	
1 seme	ster	undergraduate			
Conten	ts				
Physica	al laws	of Nuclear and Elementa	ary Particle Physics.		
Intend	ed lear	ning outcomes			
The stu	ıdents	have knowledge of the b	asic contexts and pri	nciples of Nuclear ar	nd Elementary Particle Physics.
Course	s (type	, number of weekly cont	act hours, language –	- if other than Germa	an)
V + Ü (ı	no info	rmation on SWS (weekly	contact hours) and c	ourse language avail	able)
		sessment (type, scope, l			ation offered — if not every seme-
written	exami	nation (approx. 120 mini	utes)		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				



Module	e title	_			Abbreviation	
Experi	mental	Physics 7 (Solid State Pl	nenomena [Semicono	luctor, Supercon-	11-E7-072-m01	
		gnetism])			, ,	
Module	e coord	inator		Module offered by		
Manag	ing Dir	ector of the Institute of A	pplied Physics	Faculty of Physics	and Astronomy	
ECTS		od of grading	Only after succ. cor	npl. of module(s)		
4	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 seme	ster	undergraduate				
Conten	its					
Physica	al laws	of solid-state phenomen	a (semiconductors, s	superconductivity, m	agnetism)	
Intend	ed lear	ning outcomes				
	ogical r				erfaces; superconductivity: pheno- mean field description of magne-	
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	an)	
V + Ü (ı	no info	rmation on SWS (weekly	contact hours) and c	ourse language avai	lable)	
		sessment (type, scope, la ion on whether module c			ation offered — if not every seme-	
written	exami	nation (approx. 120 minu	ites)			
Allocation of places						
Additio	nal inf	ormation				
	_					
Referre	ed to in	LPO I (examination regu	llations for teaching-	degree programmes)	
Referre	d to in	LPO I (examination regu	lations for teaching-	degree programmes)	



Module title					Abbreviation
Advanced Practical Course Bachelor					11-PFB-072-m01
Module coordinator				Module offered by	
Managing Director of the Institute of Applied Physics			oplied Physics	Faculty of Physics and Astronomy	
ECTS	Meth	Method of grading Only after succ. cor		npl. of module(s)	
4	(not) successfully completed 11-E1, 11-E2				
Duratio	Duration Module level		Other prerequisites		
1 seme	1 semester undergraduate		11-A3		
Contor	,tc				

Principles of Nuclear, Atomic and Molecular Physics, experiments on cryogenic temperatures and correlated systems, properties of solids, surfaces and interfaces.

Intended learning outcomes

The students have knowledge of conducting an experiment and of analysing and documenting the experimental results. They have basic knowledge of issuing a scientific publication and of using modern evaluation systems. They are able to work on a task based on publications and to acquire practical experimental methods.

 $\textbf{Courses} \ (\textbf{type}, \textbf{number of weekly contact hours, language} - \textbf{if other than German})$

Fortgeschrittenen-Praktikum Bachelor Theorie (Advanced Practical Course Bachelor Theory): S (1 weekly contact hour)

Fortgeschrittenen-Praktikum Bachelor Praxis (Advanced Practical Course Bachelor Practice): P (3 weekly contact hours)

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

This module has the following assessment components

- 1. Seminar: talk (with discussion) demonstrating the students' understanding of the physics-related aspects of the experiments to be prepared (approx. 30 minutes)
- 2. Lab course: Preparing, performing and evaluating the experiments will be considered successfully completed if a Testat (exam) is passed. Students must prepare an experiment log (8 to 10 pages).

Students must register for assessment components 1 and 2 online (details to be announced). To pass this module, students must pass both assessment component 1 and assessment component 2.

Allocation of places -Additional information -Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module title	Abbreviation				
Ordinary Differential Equations	10-M-ODE-082-m01				
Module coordinator	Module offered by				
Dean of Studies Mathematik (Mathematics)	Institute of Mathematics				
	ucc. compl. of module(s)				
5 numerical grade					
Duration Module level Other pro	quisites				
sessmen at the be sidered a dents ha the cours sessmen ted to as sessmen	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.				
Existence and uniqueness theorem, continuous ferential equations, matrix exponential series, lin	pendance of solutions on initial values, systems of linear dif- r differential equations of higher order.				
Intended learning outcomes					
The student is acquainted with the fundamental equations. He/she is able to apply these method	ncepts and methods of the theory of ordinary differential o practical problems.				
Courses (type, number of weekly contact hours,	guage — if other than German)				
V + Ü (no information on SWS (weekly contact ho	s) and course language available)				
Method of assessment (type, scope, language – ster, information on whether module can be chosen	other than German, examination offered — if not every semeto earn a bonus)				
	nced by the lecturer, the written examination can be replaced ox. 20 minutes) or an oral examination in groups (groups of upon with the examiner				
Allocation of places					
Additional information					

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



Module title Abbreviation					Abbreviation
Basics	of Nan	ostructureTechnology			11-N1-072-m01
Module	e coord	inator		Module offered by	
Manag	ing Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	and Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Princip	les of p	roducing, characterising	and applying nanost	ructures.	
Intend	ed learı	ning outcomes			
		have knowledge of the fuructures.	ındamental propertie	s, technologies, cha	racterising methods and functi-
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	an)
V + S (r	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)
		sessment (type, scope, la on on whether module c			ation offered — if not every seme-
written	examiı	nation (approx. 90 minut	tes)		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				



Module	e title			Abbreviation	
Main S	eminar	Experimental / Theoreti	cal Physics		11-PHS-072-m01
Module	e coord	inator		Module offered by	
	_	ectors of the Institute of <i>A</i> f Theoretical Physics and		Faculty of Physics a	and Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
2	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	its				
Curren	t issues	of Theoretical/Experime	ntal Physics.		
Intend	ed lear	ning outcomes			
		have knowledge of the so or Experimental Physics.		rk and presentation	techniques of a current question
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	 ลท)
S (no i	nformat	tion on SWS (weekly cont	act hours) and cours	e language available	e)
		sessment (type, scope, la ion on whether module ca			ation offered — if not every seme-
talk (ap	oprox. 3	30 to 45 minutes) with dis	scussion		
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)				



Module title	<u> </u>			Abbreviation
Laboratory	and Measurement Tech	ınology		11-A3-072-m01
Module coo	rdinator		Module offered by	
Managing D	irector of the Institute	of Applied Physics	Faculty of Physics	and Astronomy
ECTS Me	thod of grading	Only after succ. o	compl. of module(s)	
6 nur	nerical grade			
Duration	Module level	Other prerequisi	tes	
<u> </u>		50% of exercises sion to assessment the leaders have obtained to assessment into mitted to assessment into	Other prerequisites Admission prerequisite to assessment: successful completion of appro 50% of exercises. Certain prerequisites must be met to qualify for admi sion to assessment. The lecturer will inform students about the respect ve details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification	

Introduction to electronic and optical measuring methods of physical metrology, vacuum technology and cryogenics, cryogenics, light sources, spectroscopic methods and measured value acquisition.

Intended learning outcomes

The students have acquired the following transferable skills: Electronic and optical measuring methods in physical metrology, cryogenics and vacuum technology, cryogenics, light sources, spectroscopic methods and measured value acquisition.

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

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

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

written examination (approx. 120 minutes)

Allocation of places

Only as part of pool of general key skills (ASQ): 15 places. Places will be allocated by lot.

Additional information

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

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Modul	Module title Abbreviation						
Mathe	Mathematics for Physicists 1 10-M-PHY1-072-m01						
Modul	e coord	inator		Module offered by			
Dean c	of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics		
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)			
10	nume	rical grade					
Duration	on	Module level	Other prerequisites				
1 seme	ester	undergraduate					
Conter	nts						
		nbers and functions, seq e differential equations.	uences and series, di	fferential and integr	al calculus in one variable, vector		
Intend	ed lear	ning outcomes					
	_	ets acquainted with basi in natural sciences, in pa	•		s to apply these methods to sim- et the results.		
Course	es (type	, number of weekly conta	ict hours, language –	- if other than Germa	ın)		
V + Ü (no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)		
		sessment (type, scope, la			ntion offered — if not every seme-		
writter	exami	nation (90 minutes)					
Allocat	tion of	places					
Additional information							
Referred to in LPO I (examination regulations for teaching-degree programmes)							



Module	Module title Abbreviation							
Mathematics for Physicists 2 10-M-PHY2-072-m01								
Module	e coord	inator		Module offered by				
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics			
ECTS	Metho	od of grading	Only after succ. con	ıpl. of module(s)				
8	nume	rical grade						
Duratio	n	Module level	Other prerequisites					
1 seme	ster	undergraduate						
Conten	ts							
Intendent The stuse met	everal ed lear ident g hods to	variables, differential eq ning outcomes ets acquainted with fund o problems in natural scie	uations, Fourier analy amental concepts of ences, in particular in	advanced mathema physics, and is able	·			
		, number of weekly conta rmation on SWS (weekly						
Method ster, in	d of ass formati	•	nguage — if other the	an German, examina	ition offered — if not every seme-			
Allocation of places								
Additional information								
Referred to in LPO I (examination regulations for teaching-degree programmes)								



Module	Module title Abbreviation						
Mather	matics	3 for students of Physics	and Engineering	-	11-MPl3-062-m01		
Module	e coord	inator		Module offered by			
	Managing Director of the Institute of Theoretical Physi and Astrophysics		neoretical Physics	Faculty of Physics a	and Astronomy		
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)			
8	nume	rical grade					
Duratio	n	Module level	Other prerequisites	i .			
1 seme.	Admission prerequisite to assessment: successful completion of approximate power for admission to assessment. The lecturer will inform students about the respect ve details at the beginning of the course. Registration for the course be considered a declaration of will to seek admission to assessment students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration assessment into effect. Students who meet all prerequisites will be a mitted to assessment in the current or in the subsequent semester. For admission to assessment at a later date, students will have to obtain the qualification for admission to assessment anew.			must be met to qualify for admisorm students about the respective. Registration for the course will ek admission to assessment. If in for admission to assessment curer will put their registration for eet all prerequisites will be adnited the subsequent semester. For			
Conten	ts						
Ordina	ry and	partial differential equati	ons in Physics.				
Intende	ed lear	ning outcomes					
		have basic mathematical ntial equations.	knowledge of dynan	nic equations and so	lution methods for common and		
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	ın)		
V + Ü (r	no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)		
ster, in	Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) written examination (approx. 120 minutes)						
Allocat	Allocation of places						
Additio	Additional information						
Referre	d to in	LPO I (examination regu	lations for teaching-	degree programmes)			
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Module	Module title Abbreviation							
	Authorities of a Chalante of Director and Factor and a							
Matric	nathematics 4 for Students of Physics and Engineering							
Module	Module coordinator Module offered by							
	Managing Director of the Institute of Theoretical Physic and Astrophysics			Faculty of Physics a	and Astronomy			
ECTS		od of grading	Only after succ. con	npl. of module(s)				
8		rical grade		,				
Duratio	on	Module level	Other prerequisites	•				
1 seme	ster	undergraduate						
Conten	ıts							
Functio	onal an	alysis and complex analy	sis.					
Intend	ed lear	ning outcomes						
		have basic knowledge of as the required calculation		ert space and the the	eory of functions of a complex va-			
Course	s (type	, number of weekly conta	ict hours, language –	- if other than Germa	an)			
V + Ü (ı	no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)			
		sessment (type, scope, la ion on whether module c			ation offered — if not every seme-			
written	exami	nation (approx. 120 minu	tes)					
Allocat	tion of p	places						
Additio	Additional information							
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)							



Modul	Module title Abbreviation						
Oral Exam Experimental Physics (Physicists) 11-PREP-072-m01							
Module coordinator Module offered by							
chairp	erson o	f examination committe	e	Faculty of Physics a	and Astronomy		
ECTS	Meth	od of grading	Only after succ. con	ipl. of module(s)			
6	nume	rical grade					
Durati	on	Module level	Other prerequisites				
1 seme	ester	undergraduate					
Conte	nts						
	•	of the examination is to ed Physics and is able to			ands basic contexts of Experimen		
Intend	ed lear	ning outcomes					
		have gained an overviev		of Experimental and	d Applied Physics and are able to		
Course	es (type	, number of weekly con	tact hours, language –	- if other than Germa	an)		
A (no i	nforma	tion on SWS (weekly co	ntact hours) and cours	e language available	e)		
		sessment (type, scope, ion on whether module			ation offered — if not every seme-		
oral ex	aminat	ion of one candidate ea	ch (approx. 30 minute	s)			
Alloca	tion of _I	places					
Additi	onal inf	ormation					
Referr	ed to in	LPO I (examination reg	ulations for teaching-	degree programmes)			
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	n Theoretical Physics			Module title Abbreviation					
Module c				11-PRT-072-m01					
	oordinator		Module offered by						
 chairpers	on of examination commit	ee	Faculty of Physics a	and Astronomy					
ECTS N	Method of grading	Only after succ. con	npl. of module(s)						
6 n	umerical grade								
Duration	Module level	Other prerequisites	•						
1 semeste	er undergraduate								
Contents									
	ose of the examination is to and is able to apply the acq			ands basic contexts of Theoretical					
intended	learning outcomes								
	ents have gained an overviolientific methods.	ew of the basic contexts	of Theoretical Phys	ics and are able to apply the ac-					
Courses ((type, number of weekly co	ntact hours, language –	- if other than Germa	an)					
A (no info	ormation on SWS (weekly c	ontact hours) and cours	e language available	e)					
	of assessment (type, scope rmation on whether module			ation offered — if not every seme-					
oral exam	nination of one candidate e	ach (approx. 30 minute	s)						
Allocatio	n of places								
Additional information									
Referred to in LPO I (examination regulations for teaching-degree programmes)									



Additional information

§ 73 (1) 5. Mathematik Angewandte Mathematik

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Modul					Abbreviation	
Numer	ical Ma	thematics 1			10-M-NM1-082-m01	
Modul	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics	
ECTS	-	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
Conter	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective detail at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as sessment into effect. Students who meet all prerequisites will be admited to assessment in the current or in the subsequent semester. For as sessment at a later date, students will have to obtain the qualification admission to assessment anew.			ents about the respective details tion for the course will be connission to assessment. If stubra admission to assessment over will put their registration for astet all prerequisites will be admitted subsequent semester. For astave to obtain the qualification for		
		stems of linear equation: ition with polynomials, s _i			quations and systems of equati- rical integration.	
		ning outcomes		,		
		s acquainted with the fun oblems and knows abou			erical mathematics, applies them	
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	ın)	
V + Ü (no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
	Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)					
by an o	written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes) Language of assessment: German, English if agreed upon with the examiner					
Allocat	Allocation of places					
					-	

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



Module	Module title Abbreviation						
Numerio	al Ma	thematics 2			10-M-NM2-082-m01		
Module	coord	inator		Module offered by			
Dean of	Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
5	nume	rical grade					
Duration	n	Module level	Other prerequisites	Other prerequisites			
Duration Module level 1 semester undergraduate		sessment. The lecturation at the beginning of the sidered a declaration dents have obtained the course of the sessment into effect ted to assessment i	rer will inform stude the course. Registrat in of will to seek adm d the qualification fo mester, the lecturer t. Students who mee n the current or in th date, students will h	alify for admission to as- nts about the respective details ion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- ot all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for			

Solution methods and applications for eigenvalue problems, linear programming, initial value problems for ordinary differential equations, boundary value problems.

Intended learning outcomes

The student is able to draw a distinction between the different concepts of numerical mathematics and knows about their advantages and limitations concerning the possibilities of application in different fields of natural and engineering sciences and economics.

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

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

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

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

Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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

§ 73 (1) 5. Mathematik Angewandte Mathematik



Module	Module title Abbreviation							
		al Course B for Students o	11-PGA-PGR-072-m01					
ching I	ching Degree)							
Module	Module coordinator Module offered by							
Manag	Managing Director of the Institute of Applied Physics			Faculty of Physics and Astronomy				
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)				
6	(not)	successfully completed						
Duratio	Duration Module level		Other prerequisites					
1 seme	1 semester undergraduate		Recommended: 11-PFR					
								

Physical laws of mechanics, thermodynamics, optics, science of electricity, vibrations and waves.

Intended learning outcomes

The students have knowledge and skills of physical measuring instruments and experimental techniques. They are able to independently plan and conduct experiments in cooperation with others, and to document the results in a measurement protocol.

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

Beispiele aus Mechanik, Wärmelehre und Elektrik (Examples from Mechanics, Thermodynamics and Electricity, BAM): P (2 weekly contact hours)

Klassische Physik (Classical Physics, KLP): P (2 weekly contact hours)

Elektrizitätslehre und Schaltungen (Electricity and Circuits, ELS): P (2 weekly contact hours)

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

This module has the following assessment components

- 1. Lab course in part 1: a) Preparing, performing and evaluating the experiments will be considered successfully completed if a Testat (exam) is passed. b) Talk (with discussion) to test the students' understanding of the physics-related contents of the course (approx. 30 minutes).
- 2. Lab course in part 2: a) Preparing, performing and evaluating the experiments will be considered successfully completed if a Testat (exam) is passed. b) Talk (with discussion) to test the students' understanding of the physics-related contents of the course (approx. 30 minutes).
- 3. Lab course in part 3: a) Preparing, performing and evaluating the experiments will be considered successfully completed if a Testat (exam) is passed. b) Talk (with discussion) to test the students' understanding of the physics-related contents of the course (approx. 30 minutes).

Students must register for assessment components 1 through 3 online (registration deadline to be announced). Students will be offered one opportunity to retake element a) and/or element b). To pass an assessment component, they must pass both elements a) and b).

To pass this module, students must successfully complete each of the three courses.

To pass this module, students must pass each of the assessment components 1 through 3.

To pass this module, students must successfully complete two out of the three courses.

Allocation of places --Additional information --Referred to in LPO I (examination regulations for teaching-degree programmes) ---



Module	e title	Abbreviation					
		dergraduate Laboratory (r Circuits)	11-PGB-PGN-072-m01				
Module	Module coordinator Module offered by						
Manag	Managing Director of the Institute of Applied Physic			Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. cor	npl. of module(s)			
4	(not)	successfully completed	11-PFR				
Duratio	Duration Module level		Other prerequisites				
1 seme	1 semester undergraduate		Recommended: 11-PGA-PGR				

Physical laws of Atomic Physics, Nuclear Physics and wave optics. Basic measuring methods using computers and storage oscilloscopes.

Intended learning outcomes

The students have knowledge and skills of physical measuring instruments and experimental techniques. They are able to independently plan and conduct experiments in cooperation with others, and to document the results in a measurement protocol.

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

Wellenoptik (Physical Optics, WOP): P (2 weekly contact hours)

Atom- und Kernphysik (Atomic and Nuclear Physics, AKP): P (2 weekly contact hours)

Computer und Messtechnik (Computers and Measurement Technology, CMT): P (2 weekly contact hours)

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

This module has the following assessment components

- 1. Lab course in part 1: a) Preparing, performing and evaluating the experiments will be considered successfully completed if a Testat (exam) is passed. b) Talk (with discussion) to test the students' understanding of the physics-related contents of the course (approx. 30 minutes).
- 2. Lab course in part 2: a) Preparing, performing and evaluating the experiments will be considered successfully completed if a Testat (exam) is passed. b) Talk (with discussion) to test the students' understanding of the physics-related contents of the course (approx. 30 minutes).

Students must register for assessment components 1 and 2 online (registration deadline to be announced). Students will be offered one opportunity to retake element a) and/or element b). To pass an assessment component, they must pass both elements a) and b).

To pass this module, students must successfully complete two out of the three courses.

To pass this module, students must pass both assessment component 1 and assessment component 2.

Allocation of places

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Additional information

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

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Programming course for students of Mathematics and other subjects Module offered by Dean of Studies Mathematik (Mathematics) Institute of Mathematics ECTS Method of grading Only after succ. compl. of module(s) 3 (not) successfully completed	Module	Nodule title Abbreviation						
Dean of Studies Mathematik (Mathematics) Institute of Mathematics	Progra	rogramming course for students of Mathematics and other subjects 10-M-PRG-082-m01						
ECTS Method of grading Only after succ. compl. of module(s)	Module	e coord	inator		Module offered by			
Note Semister Duration Module level Other prerequisites	Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathen	natics		
Duration Module level Other prerequisites 1 semester undergraduate Admission prerequisite to assessment: regular attendance (attendance monitored, a maximum of one incident of unexcused absence). Contents Basics of a modern programming language (e. g. C or Fortran) taking into account the particular needs in mathematics. Intended learning outcomes The student is able to work independently on small programming exercises and standard programming problem in mathematics. Courses (type, number of weekly contact hours, language — if other than German) P (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) project in the form of programming exercises (as specified at the beginning of the course) Language of assessment: German, English if agreed upon with the examiner Allocation of places Additional information Referred to in LPO I (examination regulations for teaching-degree programmes)	ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)			
Admission prerequisite to assessment: regular attendance (attendance monitored, a maximum of one incident of unexcused absence). Contents Basics of a modern programming language (e. g. C or Fortran) taking into account the particular needs in mathematics. Intended learning outcomes The student is able to work independently on small programming exercises and standard programming problem in mathematics. Courses (type, number of weekly contact hours, language — if other than German) P (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) project in the form of programming exercises (as specified at the beginning of the course) Language of assessment: German, English if agreed upon with the examiner Allocation of places Additional information Referred to in LPO I (examination regulations for teaching-degree programmes)	3	(not)	successfully completed					
monitored, a maximum of one incident of unexcused absence). Contents Basics of a modern programming language (e. g. C or Fortran) taking into account the particular needs in mathematics. Intended learning outcomes The student is able to work independently on small programming exercises and standard programming problem in mathematics. Courses (type, number of weekly contact hours, language — if other than German) P (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) project in the form of programming exercises (as specified at the beginning of the course) Language of assessment: German, English if agreed upon with the examiner Allocation of places Additional information Referred to in LPO I (examination regulations for teaching-degree programmes)	Duratio	on	Module level	Other prerequisites				
Basics of a modern programming language (e. g. C or Fortran) taking into account the particular needs in mathematics. Intended learning outcomes The student is able to work independently on small programming exercises and standard programming problem in mathematics. Courses (type, number of weekly contact hours, language — if other than German) P (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) project in the form of programming exercises (as specified at the beginning of the course) Language of assessment: German, English if agreed upon with the examiner Allocation of places Additional information Referred to in LPO I (examination regulations for teaching-degree programmes)	1 seme	ster	undergraduate	1		_		
Intended learning outcomes The student is able to work independently on small programming exercises and standard programming problem in mathematics. Courses (type, number of weekly contact hours, language — if other than German) P (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) project in the form of programming exercises (as specified at the beginning of the course) Language of assessment: German, English if agreed upon with the examiner Allocation of places Additional information Referred to in LPO 1 (examination regulations for teaching-degree programmes)	Conten	its						
The student is able to work independently on small programming exercises and standard programming problem in mathematics. Courses (type, number of weekly contact hours, language — if other than German) P (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) project in the form of programming exercises (as specified at the beginning of the course) Language of assessment: German, English if agreed upon with the examiner Allocation of places Additional information Referred to in LPO I (examination regulations for teaching-degree programmes)			odern programming lang	uage (e. g. C or Fortra	n) taking into accou	nt the particular needs in mathe-		
in mathematics. Courses (type, number of weekly contact hours, language — if other than German) P (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) project in the form of programming exercises (as specified at the beginning of the course) Language of assessment: German, English if agreed upon with the examiner Allocation of places Additional information Referred to in LPO I (examination regulations for teaching-degree programmes)	Intend	ed lear	ning outcomes					
P (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) project in the form of programming exercises (as specified at the beginning of the course) Language of assessment: German, English if agreed upon with the examiner Allocation of places Additional information Referred to in LPO I (examination regulations for teaching-degree programmes)				ntly on small progran	nming exercises and	standard programming problems		
Method of assessment (type, scope, language — if other than German, examination offered — if not every seme ster, information on whether module can be chosen to earn a bonus) project in the form of programming exercises (as specified at the beginning of the course) Language of assessment: German, English if agreed upon with the examiner Allocation of places Additional information Referred to in LPO I (examination regulations for teaching-degree programmes)	Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	an)		
ster, information on whether module can be chosen to earn a bonus) project in the form of programming exercises (as specified at the beginning of the course) Language of assessment: German, English if agreed upon with the examiner Allocation of places Additional information Referred to in LPO I (examination regulations for teaching-degree programmes)	P (no ir	nforma	tion on SWS (weekly con	tact hours) and cours	e language available	e)		
Language of assessment: German, English if agreed upon with the examiner Allocation of places Additional information Referred to in LPO I (examination regulations for teaching-degree programmes)						ation offered — if not every seme-		
Additional information Referred to in LPO I (examination regulations for teaching-degree programmes)				•		he course)		
Referred to in LPO I (examination regulations for teaching-degree programmes)	Allocat	ion of	places					
Referred to in LPO I (examination regulations for teaching-degree programmes)				-				
	Additio	Additional information						
	Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)						
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Modul	Module title Abbreviation						
Theore	etical P	hysics 1 (Theoretical Mo	11-T1-072-m01				
Modul	e coord	inator		Module offered by			
_	ging Directory	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	and Astronomy		
ECTS	Meth	od of grading	Only after succ. cor	mpl. of module(s)			
8	nume	rical grade					
Durati	on	Module level	Other prerequisites	3			
1 seme	ester	undergraduate					
Conte	nts						
Newto	nian m	echanics, Lagrangian m	echanics, Hamiltoniar	equation of motion	, conservation laws.		
Intend	ed lear	ning outcomes					
The stu		have knowledge of the	principles of classical	theoretical mechanic	cs and the required calculation		
Course	es (type	, number of weekly con	tact hours, language -	– if other than Germa	 an)		
		rmation on SWS (weekl					
		sessment (type, scope, ion on whether module			ation offered — if not every seme-		
writter	exami	nation (approx. 120 mir	nutes)				
Alloca	tion of	places					
Additio	onal inf	ormation					
Referred to in LPO I (examination regulations for teaching-degree programmes)							
		,	, 0				



e title	,	Abbreviation			
Theoretical Physics 2 (Theoretical Electrostatics and Elektrodynamics)				11-T2-072-m01	
e coord	inator		Module offered by		
Managing Director of the Institute of Theoretica and Astrophysics			Faculty of Physics and Astronomy		
Meth	od of grading	Only after succ. compl. of module(s)			
nume	rical grade				
on	Module level	Other prerequisites			
ester	undergraduate				
nts					
statics	, magnetostatics, Maxwe	ll equations, covaria	nt formulation, electi	rodynamics and matter.	
ed lear	ning outcomes				
The students have knowledge of the principles of classical electrodynamics and the required calculation methods.					
es (type	, number of weekly conta	ct hours, language –	- if other than Germa	an)	
no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)					
written examination (approx. 120 minutes)					
Allocation of places					
Additional information					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
	e coord ing Dire trophys Methe nume on ester nts estatics, ed learn udents d of ass formati examin tion of p	e coordinator ing Director of the Institute of Tratrophysics Method of grading numerical grade on Module level ester undergraduate ots estatics, magnetostatics, Maxwe ed learning outcomes udents have knowledge of the process (type, number of weekly contains information on SWS (weekly of dof assessment (type, scope, later information on whether module can examination (approx. 120 minustion of places	e coordinator ing Director of the Institute of Theoretical Physics itrophysics Method of grading numerical grade on Module level ester undergraduate ostatics, magnetostatics, Maxwell equations, covariance dearning outcomes adents have knowledge of the principles of classical est (type, number of weekly contact hours, language—no information on SWS (weekly contact hours) and contact dof assessment (type, scope, language—if other the formation on whether module can be chosen to earn examination (approx. 120 minutes) tion of places onal information	etical Physics 2 (Theoretical Electrostatics and Elektrodynamics) e coordinator ting Director of the Institute of Theoretical Physics strophysics Method of grading numerical grade on Module level ester undergraduate on Module level ester undergraduate on this statics, magnetostatics, Maxwell equations, covariant formulation, electrodynamics and electrodynamics and ester (type, number of weekly contact hours, language — if other than Germano information on SWS (weekly contact hours) and course language availed of assessment (type, scope, language — if other than German, examination on whether module can be chosen to earn a bonus) tion of places onal information	



Module title					Abbreviation	
Theoretical Physics 3 (Theoretical Quantum Mechanics)				11-T3-072-m01		
Modul	e coord	inator		Module offered by		
Managing Director of the Institute of Theore and Astrophysics			neoretical Physics	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	succ. compl. of module(s)		
8	nume	rical grade				
Duration	on	Module level	Other prerequisites			
1 seme	ester	undergraduate				
Conter	nts					
	Limits of classical physics, Schrödinger equation, mathematical foundations of quantum mechanics, harmonic oscillator, angular momentum and spin, hydrogen atom, many-particle systems.					
Intend	ed lear	ning outcomes				
The stu	udents	have knowledge of the pr	rinciples of quantum	mechanics and the r	required calculation methods.	
Course	es (type	, number of weekly conta	ict hours, language –	- if other than Germa	an)	
V + Ü (no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)						
written	written examination (approx. 120 minutes)					
Allocation of places						
Additional information						
Referred to in LPO I (examination regulations for teaching-degree programmes)						



Module title Theorectical Physics 3 FOKUS (Theoretical Quantum Mechanics)					Abbreviation	
					11-T3F-072-m01	
Modul	e coord	linator		Module offered by		
Managing Director of the Institute of Theoretical Phyand Astrophysics			Theoretical Physics	Faculty of Physics and Astronomy		
ECTS	Meth	od of grading	Only after succ. co	ompl. of module(s)		
8	nume	rical grade				
Durati	on	Module level	Other prerequisites			
1 seme	1 semester undergraduate					
Conte	nts					
Limits of classical physics, Schrödinger equation, mathematical foundations of quantum mechanics, harmonic oscillator, angular momentum and spin, hydrogen atom, many-particle systems						
	_	ning outcomes				
		-	·		required calculation methods	
		, number of weekly con				
V + Ü (no info	rmation on SWS (weekl	y contact hours) and o	ourse language avai	lable)	
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)						
written examination (approx. 120 minutes)						
Allocation of places						
Additional information						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
						



Modul	Module title Abbreviation						
Theorectical Physics 4 (Theoretical Thermodynamics and Statistics)							
Theoretical Thysics 4 (Theoretical Thermodynamics and Statistics)					11-T4-072-m01		
Modul	Module coordinator Mod				Module offered by		
Managing Director of the Institute of Theoretica and Astrophysics			heoretical Physics	Faculty of Physics and Astronomy			
ECTS	Meth	od of grading	Only after succ. co	ucc. compl. of module(s)			
8	nume	rical grade					
Durati	ion	Module level	Other prerequisites				
1 sem	ester	undergraduate					
Conte	nts						
	Principles of thermodynamics, fundamental theorems, thermodynamic potentials, principles of statistical mechanics.						
Intend	led lear	ning outcomes					
The students have knowledge of the principles of thermodynamics and statistical mechanics and the required calculation methods.							
Cours	es (type	, number of weekly cont	act hours, language -	– if other than Germa	an)		
V + Ü (no information on SWS (weekly contact hours) and course language available)							
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)							
written examination (approx. 120 minutes)							
Allocation of places							
Additional information							
Referred to in LPO I (examination regulations for teaching-degree programmes)							