Julius-Maximilians-
UNIVERSITÄT
WÜRZBURG

Subdivided Module Catalogue

for the Subject

Nanostructure Technology

as a Master's with 1 major

with the degree "Master of Science"

(120 ECTS credits)

Examination regulations version: 2010
Responsible: Faculty of Physics and Astronomy

Course of Studies - Contents and Objectives

The Master of Science program prepares students for scientific work in the field of Nanostructure Technology. Graduates of the program are qualified to pursue doctoral studies. The objective of the study program is to convey to the student an in-depth understanding of physical and technological principles relevant to the fields of applied physics and nanoscience. The program aims to develop not only physics knowledge, but also analytical thinking and problem solving skills, preparing the student for the constantly evolving fields in which physicists and technologists typically work. The granted degree is internationally comparable to a Masters degree in applied physics or nanotechnology.

Abbreviations used

Course types: **E** = field trip, **K** = colloquium, **O** = conversatorium, **P** = placement/lab course, **R** = project, **S** = seminar, **T** = tutorial, **Ü** = exercise, **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:

ASPO2007

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

21-Sep-2010 (2010-60)

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 (36 ECTS credits)				
11-PFM-072-m01	Advanced Practical Course Master	6	B/NB	154
11-FS-N-072-m01	Professional Specialization Nanostructure Technology	15	NUM	108
11-MP-N-072-m01	Scientific Methods and Project Management Nanostructure Technology	15	NUM	132
Compulsory Electives (54 ECTS credits) The area of mandatory electives (54 ECTS credits) comprises: mandatory electives area NM ("Nanomatrix"): 24 ECTS credits. Out of the nine modules that are offered, four must be successfully completed. mandatory electives area SP ("Spezialausbildung Nanostrukturtechnik" ("Special Training Nanostructure Technology")): 24 ECTS credits. Students must complete no less than three modules. Within the area SP, modules are grouped together by subject. Students may select modules worth a maximum of 24 ECTS credits from one of these module groups. Students also have the option to select modules from different module groups and worth different numbers of credits (total number of credits achieved must be 24). mandatory electives area NT ("Nicht-technischer Wahlbereich" ("Non-technical Electives")): 6 ECTS credits. Students must take a minimum of one module.				
Compulsory Electives Nanomatrix (24 ECTS credits) Out of the nine modules that are offered, four must be successfully completed.				
08-NM-AW-MA-072-m01	Nanomatrix Inorganic Materials Chemistry (Master)	6	NUM	23
08-NM-NS-MA-072-m01	Nanoparticle Synthesis and Structuring Technologies (Master)	6	NUM	24
11-NM-WP-MA-072-m01	Nanomatrix Heat Insulating Systems and Photovoltaics	6	NUM	147
11-NM-HM-MA-072-m01	Nanomatrix Semiconductor Materials (Master)	6	NUM	144
11-NM-HP-MA-072-m01	Nanomatrix Semiconductor Processing (Master)	6	NUM	145
11-NM-MB-MA-072-m01	Nanomatrix Micro/Nano- and Optoelectronic Devices (Master)	6	NUM	146
03-NM-BW-MA-072-m01	Nanomatrix Biomedical Materials (Master)	6	NUM	19
07-NM-BS-MA-072-m01	Nanomatrix Biocompatible Structuring Technologies (Master)	6	NUM	20
11-NM-BV-MA-072-m01	Nanomatrix Biophysical Analyzing Systems and Processes (Master)	6	NUM	143
Compulsory Electives Specialisation Nanostructure Technology (24 ECTS credits) Out of the 24 modules that are offered, no less than three must be completed.				
Applied Physics and Metrology (24 ECTS credits)				
11-MOE-092-m01	Opto-electronic Material Properties	5	NUM	130
08-SAM-092-m01	Technology of Sensor and Actor Materials including Smart Fluids	5	NUM	26
11-OHL-092-m01	Organic Semiconductor	5	NUM	152
11-A2-081-m01	Electronics	6	NUM	59
08-EEW-101-m01	Electrochemical Energy Storage and Conversion	5	NUM	21
11-FPA-112-m01	Visiting Research Project	10	NUM	107
11-ASI-092-m01	Reproducing Sensors in Infrared	3	NUM	62
11-ASL-092-m01	Applied Superconduction	6	NUM	64
11-EBV-092-m01	Principles of Image Processing	3	NUM	81
11-ENT-092-m01	Principles of Energy Technologies	6	NUM	85
11-EPP-092-m01	Introduction to Plasmaphysics	6	NUM	87
11-HLF-092-m01	Semiconductor Lasers - Principles and Current Research	6	NUM	111
11-KVM-092-m01	Principles of Classification of Patterns	3	NUM	119
11-LVW-092-m01	Introduction to LabVIEW	6	NUM	125
11-TDO-092-m01	Thermodynamics and Economics	6	NUM	191
11-NTE-092-m01	Nanotechnology in Energy Research	4	NUM	150

08-PCM4-PHY-111-m01	Ultrafast Spectroscopy and Quantum Control	5	NUM	25
08-MW-PHY-111-m01	Structure and Properties of Modern Materials: Experiments and Simulations	5	NUM	22
11-ZDR-111-m01	Principles of two- and threedimensional Röntgen imaging	6	NUM	202
11-TDOE-141-m01	Thermodynamics and Economics	3	B/NB	193
11-BSV-122-m01	Image and Signal Processing in Physics	6	NUM	72
11-BMS-121-m01	Imaging Methods at the Synchrotron	4	NUM	66
11-BMS-131-m01	Imaging Methods at the Synchrotron	4	NUM	68
11-BSV-131-m01	Image and Signal Processing in Physics	6	NUM	74
11-PMM-132-m01	Physics of Advanced Materials	6	NUM	158
11-QUI-132-m01	Quantum Information Technology	6	NUM	165
Solid State Physics and Nanostructures (24 ECTS credits)				
11-MOE-092-m01	Opto-electronic Material Properties	5	NUM	130
11-FPA-112-m01	Visiting Research Project	10	NUM	107
11-ASL-092-m01	Applied Superconduction	6	NUM	64
11-HLF-092-m01	Semiconductor Lasers - Principles and Current Research	6	NUM	111
11-AHL-092-m01	Applied Semiconductor Physics	6	NUM	60
11-FK2-092-m01	Solid State Physics 2	8	NUM	100
11-FKS-092-m01	Solid State Spectroscopy	6	NUM	102
11-FKT-092-m01	Transport Phenomena in Solids	6	NUM	105
11-HLP-092-m01	Semiconductor Physics	6	NUM	113
11-HNS-092-m01	Semiconductor Nanostructures	6	NUM	115
11-LHQ-092-m01	Lithography in Semiconductor Technology and Theory of Quantum Transport	6	NUM	121
11-MAG-092-m01	Magnetism	6	NUM	127
11-MST-092-m01	Magnetism and Spin Transport	6	NUM	135
11-NAN-092-m01	Nanoanalytics	6	NUM	137
11-NDS-092-m01	Low-Dimensional Structures	4	NUM	139
11-NEL-092-m01	Nanoelectronics	6	NUM	141
11-NOP-092-m01	Nano-Optics	4	NUM	148
11-QM2-092-m01	Quantum Mechanics II	8	NUM	161
11-QPM-092-m01	Quantum Phenomena in electronic correlated Materials	6	NUM	163
11-QVTP-092-m01	Many Body Quantum Theory	8	NUM	166
11-RMS-092-m01	Relativistic Effects in Mesoscopic Systems	5	NUM	170
11-TFK-092-m01	Theoretical Solid State Physics	8	NUM	195
11-TSL-092-m01	Theory of Superconduction	5	NUM	200
11-RMFT-102-m01	Renormalization Group Methods in Field Theory	6	NUM	168
11-SPI-102-m01	Spintronics	6	NUM	189
11-MSS-102-m01	Methods in Surface Spectroscopy	4	NUM	133
11-EEW-102-m01	Electron Electron Interaction	4	NUM	83
11-TFK2-111-m01	Theoretical Solid State Physics 2	8	NUM	197
11-ZDR-111-m01	Principles of two- and threedimensional Röntgen imaging	6	NUM	202
11-IEM-111-m01	Introduction to Electron Microscopy	4	NUM	117
11-FTFK-112-m01	Field Theory in Solid State Physics	8	NUM	109
11-DFT-142-m01	Density Functional Theory and the Physics of Oxide Heterostructure	4	NUM	80

11-CMS-122-m01	Computational Materials Science	8	NUM	76
11-CMS-131-m01	Computational Materials Science	8	NUM	78
11-FKS2-132-m01	Solid State Spectroscopy 2	6	NUM	104
11-TFP-132-m01	Topology in Solid State Physics	6	NUM	199
Complex Systems, Quantum Control and Biophysics (24 ECTS credits)				
11-NOP-092-m01	Nano-Optics	4	NUM	148
11-BMT-092-m01	Biophysical Measurement Technology in Medical Science	6	NUM	70
11-LMB-092-m01	Laboratory and Measurement Technology in Biophysics	6	NUM	123
11-PKS-092-m01	Physics of Complex Systems	6	NUM	156
11-QIC-092-m01	Quantum Information and Quantum Computing	5	NUM	159
11-SDC-092-m01	Statistics, Data Analysis and Computer Physics	4	NUM	172
Other Modules Specialisation (24 ECTS credits)				
11-SF-4E-072-m01	Module Type 4E Special Training Experimental Physics	4	NUM	174
11-SF-4I-072-m01	Module Type 4I Special Training Interdisciplinary Research Fields	4	NUM	175
11-SF-4T-072-m01	Module Type 4T Special Training Theoretical Physics	4	NUM	177
11-SF-5E-072-m01	Module Type 5E Special Training Experimental Physics	5	NUM	178
11-SF-5I-072-m01	Module Type 5I Special Training Interdisciplinary Research Fields	5	NUM	179
11-SF-5T-072-m01	Module Type 5T Special Training Theoretical Physics	5	NUM	181
11-SF-6E-072-m01	Module Type 6E Special Training Experimental Physics	6	NUM	182
11-SF-6I-072-m01	Module Type 6I Special Training Interdisciplinary Research Fields	6	NUM	183
11-SF-6T-072-m01	Module Type 6T Special Training Theoretical Physics	6	NUM	185
11-SF-8E-072-m01	Module Type 8E Special Training Experimental Physics	8	NUM	186
11-SF-8I-072-m01	Module Type 8I Special Training Interdisciplinary Research Fields	8	NUM	187
11-SF-4N-072-m01	Module Type 4N Special Training Nanostructure Technology	4	NUM	176
11-SF-5N-072-m01	Module Type 5N Special Training Nanostructure Technology	5	NUM	180
11-SF-6N-072-m01	Module Type 6N Special Training Nanostructure Technology	6	NUM	184
11-SF-8N-072-m01	Module Type 8N Special Training Nanostructure Technology	8	NUM	188
11-EXN5-111-m01	Current Topics in Nanostructure Technology	5	NUM	89
11-EXN6-111-m01	Current Topics in Nanostructure Technology	6	NUM	90
11-EXN7-111-m01	Current Topics in Nanostructure Technology	7	NUM	91
11-EXN8-111-m01	Current Topics in Nanostructure Technology	8	NUM	92
11-EXP5-111-m01	Current Topics in Physics	5	NUM	94
11-EXP6-111-m01	Current Topics in Physics	6	NUM	95
11-EXP7-111-m01	Current Topics in Physics	7	NUM	96
11-EXP8-111-m01	Current Topics in Physics	8	NUM	97
Compulsory Electives Non-technical (6 ECTS credits) Students must take a minimum of one module.				
09-BFA4-082-m01	Geophysics for Students of Physics and Engineering	6	NUM	28
41-IK-NW1-072-m01	Basic module: Competence for Acquiring Information - for students of natural sciences	1	B/NB	204
41-IK-NW2-072-m01	Second module: Competence for Acquiring Information - for students of natural sciences	2	NUM	207

09-BFA3-Phy-082-m01	Geophysics for Students of Physics and Engineering	5	NUM	27
42-ENO-IK-072-m01	Intercultural Competence (English, Advanced Level)	3	NUM	210
42-ENO-LK-072-m01	Cultural Studies (English, Advanced Level)	3	NUM	212
42-ENO-PR-072-m01	Advanced English Final Exam	2	NUM	218
42-ENO-NW1-072-m01	English for the Natural Sciences 1 (Advanced Level)	4	NUM	214
42-ENO-NW2-072-m01	English for the Natural Sciences 2 (Advanced Level)	4	NUM	216
42-FRO-GW1-072-m01	French for the Humanities 1 (Advanced Level)	4	NUM	219
42-FRO-GW2-072-m01	French for the Humanities 2 (Advanced Level)	4	NUM	221
42-FRO-IK-072-m01	Intercultural Competence (French, Advanced Level)	3	NUM	223
42-FRO-LK-072-m01	Intercultural Competence (French, Advanced Level)	3	NUM	225
42-FRO-PR-072-m01	Advanced French Final Exam	2	NUM	227
42-FRO-W1-072-m01	French for Business 1 (Advanced Level)	4	NUM	228
42-FRO-W2-072-m01	French for Business 2 (Advanced Level)	4	NUM	230
42-SPO-GW1-072-m01	Spanish for the Humanities 1 (Advanced Level)	4	NUM	232
42-SPO-GW2-072-m01	Spanish for the Humanities 2 (Advanced Level)	4	NUM	234
42-SPO-IK-072-m01	Intercultural Competence (Spanish, Advanced Level)	3	NUM	236
42-SPO-LK-072-m01	Cultural Studies (Spanish, Advanced Level)	3	NUM	238
42-SPO-PR-072-m01	Advanced Spanish Final Exam	2	NUM	240
42-SPO-W1-072-m01	Spanish for Business 1 (Advanced Level)	4	NUM	241
42-SPO-W2-072-m01	Spanish for Business 2 (Advanced Level)	4	NUM	243
10-M-ORS-072-m01	Operations Research	5	NUM	55
10-M-NM1-082-m01	Numerical Mathematics 1	8	NUM	51
10-M-NM2-082-m01	Numerical Mathematics 2	5	NUM	53
10-M-VAN-082-m01	Advanced Analysis	8	NUM	57
02-N-P-H-082-m01	Fundamentals of Commercial Law	4	NUM	15
02-N-P-A-082-m01	Employment Law	4	NUM	10
02-N-P-G-082-m01	Introduction to Companies Law	2	NUM	11
02-N-P-W04-112-m01	European Company Law	2	NUM	16
11-EXNT6-112-m01	Non-technical Minor Subject	6	NUM	93
10-I-DB-102-m01	Databases	5	NUM	36
10-I-OOP-102-m01	Object-oriented Programming	5	NUM	38
10-I-AR-102-m01	Automation and Control Technology	8	NUM	33
10-I-BS-102-m01	Operating Systems	5	NUM	35
10-I-RAK-102-m01	Computer Architecture	5	NUM	39
10-I=PVS-102-m01	Programming of Distributed Systems	8	NUM	32
10-I=KI-102-m01	Artificial Intelligence	8	NUM	30
10-I=DB2-102-m01	Databases II	5	NUM	29
10-I=PA-102-m01	Program Design and Analysis	5	NUM	31
10-M=AAAN-102-m01	Applied Analysis	10	NUM	41
10-M=AFTH-102-m01	Complex Analysis	10	NUM	43
10-M=VGDS-102-m01	Groups and their Representations	10	NUM	45
10-M=VNPE-102-m01	Numeric of Partial Differential Equations	10	NUM	47
10-M=VQKC-102-m01	Quantum Control and Quantum Computing	5	NUM	49
02-N-P-G1-101-m01	Basic Course German Civil Code 1	10	NUM	12
02-N-P-G2-101-m01	Basic Course German Civil Code 2a and 2 b	10	NUM	13
02-N-P-G3-101-m01	Basic Course German Civil Code 3	10	NUM	14

02-N-P-W06-111-m01	German and European Trade Mark Law	3	NUM	17
02-N-P-W07-111-m01	Copyright Law and Fundamentals of Patent Law including references to EU Law	2	NUM	18
11-EXZ5-111-m01	Additional Qualifications for Engineers	5	NUM	98
11-EXZ6-111-m01	Additional Qualifications for Engineers	6	NUM	99
02-J7-112-m01	Employment law for non-law students	3	NUM	9
41-IK-NW1-101-m01	Information Literacy for Students of the Natural Sciences (Basic Level)	2	B/NB	205
41-IK-NW2-101-m01	Information Literacy for Students of the Natural Sciences (Advanced Level)	2	B/NB	208
Thesis (30 ECTS credits)				
11-MA-N-072-m01	Master Thesis Nanostructure Technology	30	NUM	129

Module title			Abbreviation
Employment law for non-law students			02-J7-112-M01
Module coordinator		**Module offered by**	
holder of the Chair of Civil Law, Employment and Labour Law and Civil Procedure		Faculty of Law	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

German contents available but not translated yet.

Die Veranstaltung Arbeitsrecht für Studierende anderer Fachrichtungen vermittelt die Grundlagen des Arbeitsrechts.

Intended learning outcomes

German intended learning outcomes available but not translated yet.

Die Studierenden haben gelernt, arbeitsrechtliche Grundlagen auf ein späteres berufliches Handlungsfeld zu applizieren.

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)
Assessment offered: once a year, winter semester

Allocation of places

Number of places: maximum 50. Students applying after not having successfully completed assessment in the past two semesters will be given preferential consideration. The remaining places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available. Places on all courses of the module component with a restricted number of places will be allocated in the same procedure.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Employment Law			02-N-P-A-082-m01
Module coordinator		**Module offered by**	
Dean of Studies Faculty of Law		Faculty of Law	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

German contents available but not translated yet.

Die Veranstaltung verschafft den Studierenden einen Überblick über System und Struktur des Arbeitsrechts und geht dabei auf die wichtigsten Problembereiche ein.

Intended learning outcomes

German intended learning outcomes available but not translated yet.

Die Studierenden haben umfassende Kenntnisse auf dem Gebiet des Individualrechts erworben. Daneben haben sie sich mit bedeutenden Fragestellungen des Kollektivarbeitsrechts auseinandergesetzt.

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)

a) written examination (approx. 120 minutes) or b) oral examination (approx. 15 minutes)

Allocation of places

Degree programm law (degree "Erste Juristische Staatsprüfung") and Bachelor's Privatrecht (Private Law) (minor with 60 ECTS credits): no restrictions. Students of other degree programmes: 20 places. Places will be allocated as follows: Students applying after not having successfully completed assessment in in the last two semesters will be given preferential consideration. The remaining places will be allocated by lot. A waiting list will be maintained and places re-allocated as they become available.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Bachelor's degree (1 major, 1 minor) Private Law (Minor, 2008)
Bachelor's degree (1 major, 1 minor) Private Law (Minor, 2011)

Module title			Abbreviation
Introduction to Companies Law			02-N-P-G-082-m01
Module coordinator		**Module offered by**	
Dean of Studies Faculty of Law		Faculty of Law	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
2	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

German contents available but not translated yet.

Gegenstand der Vorlesung sind Grundzüge des Rechts der Personengesellschaften und der GmbH.

Intended learning outcomes

German intended learning outcomes available but not translated yet.

Die Studierenden haben wesentliche Kenntnisse über die Personengesellschaften, insbesondere die oHG und die GbR erlangt. Darüber hinaus haben sie Einblicke in das Recht der Kapitalgesellschaften erhalten.

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)

a) written examination (approx. 120 minutes) or b) oral examination (approx. 15 minutes)

Allocation of places

Degree programm law (degree "Erste Juristische Staatsprüfung") and Bachelor's Privatrecht (Private Law) (minor with 60 ECTS credits): no restrictions. Students of other degree programmes: 20 places. Places will be allocated as follows: Students applying after not having successfully completed assessment in in the last two semesters will be given preferential consideration. The remaining places will be allocated by lot. A waiting list will be maintained and places re-allocated as they become available.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Bachelor's degree (1 major, 1 minor) Private Law (Minor, 2008)
Bachelor's degree (1 major, 1 minor) Private Law (Minor, 2011)

Module title			Abbreviation
Basic Course German Civil Code 1			02-N-P-G1-101-m01
Module coordinator		**Module offered by**	
Dean of Studies Faculty of Law		Faculty of Law	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
10	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Admission prerequisite to assessment: regular attendance of conversatorium.	

Contents

German contents available but not translated yet.

Der Grundkurs Bürgerliches Recht 1 führt die Studierenden in das Privatrecht ein. Er bietet eine systematische Darstellung des Allgemeinen Teils des Bürgerlichen Gesetzbuches sowie wichtiger Fragen des Schuldrechts, Allgemeiner Teil.

Intended learning outcomes

German intended learning outcomes available but not translated yet.

Die Studierenden haben umfassende Kenntnisse auf dem Gebiet des Allgemeinen Teils des Bürgerlichen Gesetzbuchs erworben. Neben der Auseinandersetzung mit Problemen des Allgemeinen Teils, lernten sie die Systematik des BGB kennen und erlernten das Arbeiten mit juristischen Fällen anhand von Beispielen.

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

V + o (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)

a) written examination (approx. 120 minutes) or b) oral examination (approx. 15 minutes)

Allocation of places

Degree programm law (degree "Erste Juristische Staatsprüfung") and Bachelor's Privatrecht (Private Law) (minor with 60 ECTS credits): no restrictions. Students of other degree programmes: 20 places. Places will be allocated as follows: Students applying after not having successfully completed assessment in in the last two semesters will be given preferential consideration. The remaining places will be allocated by lot. A waiting list will be maintained and places re-allocated as they become available.

Additional information

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Workload

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Teaching cycle

--

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Bachelor's degree (1 major, 1 minor) Private Law (Minor, 2011)

Module title			Abbreviation
Basic Course German Civil Code 2a and 2 b			02-N-P-G2-101-m01
Module coordinator		**Module offered by**	
Dean of Studies Faculty of Law		Faculty of Law	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
10	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

German contents available but not translated yet.

Der Grundkurs Bürgerliches Recht 2.1 erschließt den für das Bürgerliche Recht zentralen Bereich des Allgemeinen Schuldrechts einschließlich der Leistungsstörungen sowie die wichtigsten Fragen der vertraglichen Schuldverhältnisse. Die Vorlesung Grundkurs Bürgerliches Recht 2.2 behandelt die gesetzlichen Schuldverhältnisse Geschäftsführung ohne Auftrag, Bereicherungsrecht und Deliktsrecht.

Intended learning outcomes

German intended learning outcomes available but not translated yet.

Die Studierenden verfügen über grundlegendes Wissen auf dem Gebiet des Schuldrechts des Bürgerlichen Gesetzbuchs (§§241-432 BGB). Sie haben insbesondere Kenntnisse auf dem Gebiet des Leistungsstörungsrechts erworben und sich mit den bedeutendsten vertraglichen Schuldverhältnissen wie dem Kaufvertrag, Werkvertrag, Darlehensvertrag und der Bürgschaft sowie den gesetzlichen Schuldverhältnissen auseinandergesetzt. Die Studierenden erlernten anhand von ausgewählten Problemen des Schuldrechts das juristische Arbeiten.

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

V + 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

Degree programm law (degree "Erste Juristische Staatsprüfung") and Bachelor's Privatrecht (Private Law) (minor with 60 ECTS credits): no restrictions. Students of other degree programmes: 20 places. Places will be allocated as follows: Students applying after not having successfully completed assessment in in the last two semesters will be given preferential consideration. The remaining places will be allocated by lot. A waiting list will be maintained and places re-allocated as they become available.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Bachelor's degree (1 major, 1 minor) Private Law (Minor, 2011)

Module title			Abbreviation
Basic Course German Civil Code 3			02-N-P-G3-101-m01
Module coordinator		**Module offered by**	
Dean of Studies Faculty of Law		Faculty of Law	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
10	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Admission prerequisite to assessment: regular attendance of conversatorium.	

Contents

German contents available but not translated yet.

Gegenstand des Moduls ist das dritte Buch des BGB. Es werden die Grundlagen auf dem Gebiet des Sachenrechts vermittelt.

Intended learning outcomes

German intended learning outcomes available but not translated yet.

Die Studierenden haben grundlegendes Wissen auf dem Gebiet des Sachenrechts erworben. Sie haben insbesondere Kenntnisse über Rechtsfragen zu Besitz und Besitzschutz, das Eigentum und Fragen des Nachbarrechts, das allgemeine Grundstücksrecht, den Eigentumserwerb an Grundstücken und an beweglichen Sachen, das Rechtsverhältnis zwischen Eigentümer und Besitzer und beschränkt dingliche Rechte, wie die Dienstbarkeiten und die Sicherungsrechte (Hypothek, Grundschuld, Pfandrecht).

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

V + 0 (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)

a) written examination (approx. 120 minutes) or b) oral examination (approx. 15 minutes)

Allocation of places

Degree programm law (degree "Erste Juristische Staatsprüfung") and Bachelor's Privatrecht (Private Law) (minor with 60 ECTS credits): no restrictions. Students of other degree programmes: 20 places. Places will be allocated as follows: Students applying after not having successfully completed assessment in in the last two semesters will be given preferential consideration. The remaining places will be allocated by lot. A waiting list will be maintained and places re-allocated as they become available.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Bachelor's degree (1 major, 1 minor) Private Law (Minor, 2011)

Module title			Abbreviation
Fundamentals of Commercial Law			02-N-P-H-082-m01
Module coordinator		**Module offered by**	
Dean of Studies Faculty of Law		Faculty of Law	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

German contents available but not translated yet.

Das Modul erschließt den zentralen Bereich des Handelsrechts.

Intended learning outcomes

German intended learning outcomes available but not translated yet.

Die Studierenden haben umfassende Kenntnisse auf dem Gebiet des Handelsrechts erworben. Sie haben sich insbesondere mit den Vorschriften über die Kaufleute, das Handelsregister, die Handelsfirma, Prokura, Handlungsvollmacht, sowie den allgemeinen Vorschriften über Handelsgeschäfte und den Handelskauf beschäftigt.

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)

a) written examination (approx. 120 minutes) or b) oral examination (approx. 15 minutes)

Allocation of places

Degree programm law (degree "Erste Juristische Staatsprüfung") and Bachelor's Privatrecht (Private Law) (minor with 60 ECTS credits): no restrictions. Students of other degree programmes: 20 places. Places will be allocated as follows: Students applying after not having successfully completed assessment in in the last two semesters will be given preferential consideration. The remaining places will be allocated by lot. A waiting list will be maintained and places re-allocated as they become available.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Bachelor's degree (1 major, 1 minor) Private Law (Minor, 2008)
Bachelor's degree (1 major, 1 minor) Private Law (Minor, 2011)

Module title			Abbreviation
European Company Law			02-N-P-W04-112-m01
Module coordinator		**Module offered by**	
Dean of Studies Faculty of Law		Faculty of Law	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
2	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

German contents available but not translated yet.

Die Vorlesung behandelt die Einflüsse des Gemeinschaftsrechts auf das Gesellschaftsrecht: Niederlassungsfreiheit des EG-Vertrages, Rechtsangleichung durch Richtlinien, supranationale Rechtsformen.

Intended learning outcomes

German intended learning outcomes available but not translated yet.

Die Studierenden haben die in den letzten Jahren immer stärker in den Vordergrund getretenen europäischen Bezüge des Gesellschaftsrechts erlernt und können das deutsche Gesellschaftsrecht in den Kontext seiner europäischen Entwicklung einordnen.

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)

a) written examination (approx. 120 minutes) or b) oral examination (approx. 15 minutes)
Assessment offered: once a year, winter semester

Allocation of places

Students of the degree programme Rechtswissenschaften (Law) with the degree Erste Juristische Staatsprüfung (first state examination in law) and students of the Bachelor's degree programme Privatrecht (Private Law) (minor with 60 ECTS credits): no restrictions. Students of other degree programmes: 20 places, 10 of which will be set aside for Master's students of Economics. Should the number of places available exceed the number of applications, the remaining places can be allocated to students of other subjects/degree programmes. Should there be more than 10 applications from students of other subjects, the remaining 10 places will be allocated as follows: Students applying after not having successfully completed assessment in past years will be given preferential consideration. The remaining places will be allocated by lot. A waiting list will be maintained and places reallocated as they become available.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Economics (2014)
Master's degree (1 major) Economics (2013)

Module title			Abbreviation
German and European Trade Mark Law			02-N-P-W06-111-m01
Module coordinator		**Module offered by**	
Dean of Studies Faculty of Law		Faculty of Law	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

German contents available but not translated yet.

Die Vorlesung vermittelt einen Überblick über das Deutsche und Europäische Markenrecht. Neben den Grundlagen des Markenbegriffs und -schutzes nach dem deutschen Markengesetz werden u.a. die Voraussetzungen und Wirkungen der Europäischen Gemeinschaftsmarke nach der Gemeinschaftsmarkenverordnung behandelt. Ferner werden Spezialregelungen des deutschen Markenrechts wie z.B. zu geschäftlichen Bezeichnungen, geographischen Herkunftsangaben sowie zum kennzeichenrechtlichen Schutz von Internet Domains besprochen.

Intended learning outcomes

German intended learning outcomes available but not translated yet.

Die Studierenden können markenrechtliche Fragestellungen unter Gesichtspunkten des deutschen und europäischen Rechts analysieren.

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)

a) written examination (approx. 120 minutes) or b) oral examination (approx. 15 minutes)
Assessment offered: usually once a year, summer semester

Allocation of places

Degree programm law (degree "Erste Juristische Staatsprüfung") and Bachelor's Privatrecht (Private Law) (minor with 60 ECTS credits): no restrictions. Students of other degree programmes: 20 places. Places will be allocated as follows: Students applying after not having successfully completed assessment in in the last two semesters will be given preferential consideration. The remaining places will be allocated by lot. A waiting list will be maintained and places re-allocated as they become available.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Media Communication (2014)

Module title			Abbreviation
Copyright Law and Fundamentals of Patent Law including references to EU Law			02-N-P-W07-111-m01
Module coordinator		**Module offered by**	
Dean of Studies Faculty of Law		Faculty of Law	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
2	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

German contents available but not translated yet.

Die Veranstaltung behandelt neben den allgemeinen Grundlagen des Gewerblichen Rechtsschutzes den Schutz von Werken nach dem deutschen Urhebergesetz. In einem weiteren Veranstaltungsteil werden das Geschmacksmusterrecht sowie das Patent- und Gebrauchsmusterrecht beleuchtet.

Intended learning outcomes

German intended learning outcomes available but not translated yet.

Die Studierenden haben grundlegende Kenntnisse des Gewerblichen Rechtsschutzes und des Urheberrechts erworben. Sie können Problematiken aus diesen Bereichen in den Kontext der deutschen und europäischen Regelungen einordnen.

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)

a) written examination (approx. 120 minutes) or b) oral examination (approx. 15 minutes)
Assessment offered: usually once a year, summer semester

Allocation of places

Degree programm law (degree "Erste Juristische Staatsprüfung") and Bachelor's Privatrecht (Private Law) (minor with 60 ECTS credits): no restrictions. Students of other degree programmes: 20 places. Places will be allocated as follows: Students applying after not having successfully completed assessment in in the last two semesters will be given preferential consideration. The remaining places will be allocated by lot. A waiting list will be maintained and places re-allocated as they become available.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Media Communication (2014)
Master's degree (1 major) Economics (2014)
Master's degree (1 major) Economics (2013)

Module title			Abbreviation
Nanomatrix Biomedical Materials (Master)			03-NM-BW-MA-072-m01
Module coordinator		**Module offered by**	
chairperson of examination committee of the Master's degree programme Human-Computer Interaction		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Fundamentals and specific knowledge for engineering work in the application areas power engineering, electronics and photonics and biophysical applications as well as the technology focuses materials science, nanostructuring technologies and components and system development, especially in the area of biomedical materials.

Intended learning outcomes

Students have developed an advanced knowledge in at least one application area or technology focus of engineering work, with a particular focus on biomedical materials.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Nanomatrix Biocompatible Structuring Technologies (Master)			07-NM-BS-MA-072-m01
Module coordinator		**Module offered by**	
Dean of Studies Biologie (Biology)		Faculty of Biology	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Fundamentals as well as specific knowledge and skills for engineering work in the application directions power engineering, electronics and photonics, and biophysical applications and the technology fields of materials science, nano-structuring technologies and components and system development, in particular in the area of biocompatible structuring technologies.

Intended learning outcomes

Students have acquired advanced knowledge and skills in one or more application directions or technology fields of engineering work, in particular in the area of biocompatible structuring technologies.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Electrochemical Energy Storage and Conversion			08-EEW-101-m01
Module coordinator		**Module offered by**	
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Chemistry and application of: battery systems (aqueous and non-aqueous systems such as lead, nickel cadmium and nickel metal hydride, sodium sulphur, sodium nickel chloride, lithium ion accumulators), electrochemical double layer capacitors, redox-flow batteries, fuel cell systems (AFC, PEMFC, DMFC, PAFC, SOFC), solar cells (Si, CIS, CIGS, GaAs, organic and dye solar cell), thermoelectric devices.

Intended learning outcomes

Students have developed a knowledge of electrochemical energy storage and conversion and are able to apply that knowledge to research problems.

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

V + P + E (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 (90 minutes) and lab report (approx. 5 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title	Abbreviation
Structure and Properties of Modern Materials: Experiments and Simulations	08-MW-PHY-111-m01

Module coordinator	Module offered by
holder of the Chair of Chemical Technology of Material Synthesis	Chair of Chemical Technology of Material Synthesis

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	--

Contents

Material properties of metals and ceramics: correlation of structure/property relations through experiments and simulations.

Intended learning outcomes

Students gain an insight into the properties of modern materials: aerospace aluminium alloys and high-performance ceramics. They are introduced to measuring methods and calculation methods using numerical simulation. A special focus is on the relation between the micro/nanoscopic structure of materials and the resulting properties.

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)

talk (approx. 45 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Nanomatrix Inorganic Materials Chemistry (Master)			08-NM-AW-MA-072-m01
Module coordinator		**Module offered by**	
Dean of Studies Chemie and Pharmazie (Chemistry and Pharmacy)		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Fundamentals as well as specific knowledge and skills for engineering work in the application directions power engineering, electronics and photonics and biophysical applications and the technology fields of materials science, nano-structuring technologies and components and system development, in particular in the area of inorganic materials chemistry.

Intended learning outcomes

Students have developed advanced knowledge and skills in one or more application directions or technology fields of engineering work, in particular in the area of inorganic materials chemistry.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Nanoparticle Synthesis and Structuring Technologies (Master)			08-NM-NS-MA-072-m01
Module coordinator		**Module offered by**	
Dean of Studies Chemie and Pharmazie (Chemistry and Pharmacy)		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Fundamentals as well as specific knowledge and skills for engineering work in the application directions power engineering, electronics and photonics and biophysical applications and the technology fields of materials science, nano-structuring technologies and components and system development, in particular in the area of nanoparticle synthesis and structuring technologies.

Intended learning outcomes

Students have developed advanced knowledge and skills in one or more application directions or technology fields of engineering work, in particular in the area of nanoparticle synthesis and structuring technologies.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Ultrafast Spectroscopy and Quantum Control			08-PCM4-PHY-111-m01
Module coordinator		**Module offered by**	
lecturer of the seminar "Ultrakurzzeitspektroskopie and Quantenkontrolle"		Institute of Physical and Theoretical Chemistry	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

This module discusses advanced topics in ultrafast spectroscopy and quantum control. It focuses on ultrashort laser pulses, time-resolved laser spectroscopy and coherent control.

Intended learning outcomes

Students are able to describe the generation of ultrashort laser pulses and to characterise them. They can explain the theory of time-resolved laser spectroscopy and name experimental methods. They can describe the principles and applications of quantum control.

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

S + 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 (90 minutes) or oral examination of one candidate each (20 minutes) or talk (30 minutes)
Language of assessment: German or English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Technology of Sensor and Actor Materials including Smart Fluids			08-SAM-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Fabrication, effects and applications of sensory and actuatory materials such as piezoelectrics, shape memory materials and magnetostrictive materials. Electrorheological and magnetorheological fluids, magnetofluids.

Intended learning outcomes

Students have developed fundamental knowledge in the area of sensory and actuatory materials.

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

V + 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)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Geophysics for Students of Physics and Engineering			09-BFA3-Phy-082-m01
Module coordinator		**Module offered by**	
holder of the Professorship of Physical Geography		Institute of Geography and Geology	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Introduction to "Geophysics, Physical Properties of Geomaterials"

Intended learning outcomes

Students possess the following skills: physical key processes of the system earth as well as physical geomaterials science

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. 30 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Geophysics for Students of Physics and Engineering			09-BFA4-082-m01
Module coordinator		**Module offered by**	
holder of the Professorship of Physical Geography		Institute of Geography and Geology	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Introduction to "Geophysics, Physical Properties of Geomaterials, Methods of Applied Geophysics".

Intended learning outcomes

Students possess the following skills: physical key processes of the system earth, physical geomaterials science and methods of ground-based and geophysical exploration of the ground.

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

This module comprises 2 module components. Information on courses will be listed separately for each module component.

- 09-BFA4-1-082: V (no information on SWS (weekly contact hours) and course language available)
- 09-BFA4-2-082: 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)

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 09-BFA4-1-082: Introduction to Geophysics

- 3 ECTS, Method of grading: numerical grade
- term paper (approx. 3 to 5 pages)

Assessment in module component 09-BFA4-2-082: Methods of Applied Geophysics

- 3 ECTS, Method of grading: numerical grade
- oral examination of one candidate each (approx. 10 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Databases II			10-I=DB2-102-m01
Module coordinator		**Module offered by**	
Dean of Studies Informatik (Computer Science)		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Where applicable, prerequisites as specified by the lecturer at the beginning of the course (e. g. completion of exercises).	

Contents

Data warehouses and data mining; XML databases; web databases;introduction to Datalog.

Intended learning outcomes

The students have advanced knowledge about relational databases, XML and data mining.

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. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 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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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Computer Science (2010)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Business Information Systems (2011)
Master's degree (1 major) Business Information Systems (2013)
Master's degree (1 major) Computational Mathematics (2012)
Master's degree (1 major) Functional Materials (2012)
First state examination for the teaching degree Gymnasium Computer Science (2009)

Module title			Abbreviation
Artificial Intelligence			10-I=KI-102-m01
Module coordinator		**Module offered by**	
holder of the Chair of Computer Science VI		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Where applicable, prerequisites as specified by the lecturer at the beginning of the course (e. g. completion of exercises).	

Contents

Intelligent agents, uninformed and heuristic search, constraint problem solving, search with partial information, propositional and predicate logic and inference, knowledge representation, planning, probabilistic closure and Bayesian networks, utility theory and decidability problems, learning from observations, knowledge while learning, neural networks and statistical learning methods, reinforcement learning.

Intended learning outcomes

The students possess theoretical and practical knowledge about artificial intelligence and are able to assess possibilities for its application.

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. 80 to 90 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 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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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Computer Science (2010)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Computational Mathematics (2012)
First state examination for the teaching degree Gymnasium Computer Science (2009)

Module title			Abbreviation
Program Design and Analysis			10-I=PA-102-m01
Module coordinator		**Module offered by**	
holder of the Chair of Computer Science II		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Where applicable, prerequisites as specified by the lecturer at the beginning of the course (e. g. completion of exercises).	

Contents

Program analysis, model creation in software engineering, program quality, test of programs, process models.

Intended learning outcomes

The students are able to analyse programs, to use testing frameworks and metrics as well as to judge program quality.

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. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 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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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Computer Science (2010)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Business Information Systems (2011)
Master's degree (1 major) Business Information Systems (2013)
Master's degree (1 major) Computational Mathematics (2012)
First state examination for the teaching degree Gymnasium Computer Science (2009)

Module title			Abbreviation
Programming of Distributed Systems			10-I=PVS-102-m01
Module coordinator		**Module offered by**	
holder of the Chair of Computer Science II		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Where applicable, prerequisites as specified by the lecturer at the beginning of the course (e. g. completion of exercises).	

Contents

Design and development of parallely and distributedly executed programs.

Intended learning outcomes

The students possess the methodic knowledge and practical skills for the design and development of parallely and distributedly running programs.

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. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.
Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Computer Science (2010)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
First state examination for the teaching degree Gymnasium Computer Science (2009)

Module title			Abbreviation
Automation and Control Technology			10-I-AR-102-m01
Module coordinator		**Module offered by**	
holder of the Chair of Computer Science VII		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).	

Contents

Overview of automation systems, fundamental principles of control technology, Laplace transformation, transfer function, plant, controller types, basic feedback loop, fundamental principles of control engineering, automata, structure of Petri nets, Petri nets for automisation, machine-related structure of processing computation machines, communication between process computers and periphery devices, software for automation systems, process synchronisation, process communication, real-time operating systems, real-time planning.

Intended learning outcomes

The students master the fundamentals of automation and control.

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. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.
Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Mathematics (2012)
Bachelor' degree (1 major) Mathematics (2013)
Bachelor' degree (1 major) Computational Mathematics (2012)
Bachelor' degree (1 major) Computational Mathematics (2013)
Bachelor' degree (1 major) Aerospace Computer Science (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2011)
Master's degree (1 major) Computer Science (2010)
Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Computational Mathematics (2012)
First state examination for the teaching degree Gymnasium Computer Science (2009)

Module title			Abbreviation
Operating Systems			10-I-BS-102-m01
Module coordinator		**Module offered by**	
holder of the Chair of Computer Science II		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).	

Contents

Batch, time sharing, real-time virtual machines, system calls, processes and threads, cooperating processes, schedulers, process synchronisation, semaphores, monitors, critical regions, deadlocks, dynamic memory management, segmentation, paging, file systems, interfaces, directory structure, network file systems, hard drive organisation, basics of MS operating systems.

Intended learning outcomes

The students possess knowledge and practical skills in building and using essential parts of operating systems.

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. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 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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Workload

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Teaching cycle

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

§ 69 (1) 1. c) Informatik Technische Informatik

Module appears in

Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Aerospace Computer Science (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2011)
Master's degree (1 major) Computer Science (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Databases			10-I-DB-102-m01
Module coordinator		**Module offered by**	
Dean of Studies Informatik (Computer Science)		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).	

Contents

Relational algebra and complex SQL statements; database planning and normal forms; transaction management.

Intended learning outcomes

The students possess knowledge about database modelling and queries in SQL as well as transactions.

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. 50 to 60 minutes)
if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 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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Workload

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Teaching cycle

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

§ 49 (1) 1. b) Datenbanksysteme und Softwaretechnologie
§ 69 (1) 1. b) Datenbanksysteme und Softwaretechnologie

Module appears in

Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Mathematics (2012)
Bachelor' degree (1 major) Mathematics (2013)
Bachelor' degree (1 major) Business Information Systems (2013)
Bachelor' degree (1 major) Computational Mathematics (2012)
Bachelor' degree (1 major) Computational Mathematics (2013)
Bachelor' degree (1 major) Aerospace Computer Science (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2011)
Bachelor' degree (1 major) Functional Materials (2012)
Master's degree (1 major) Computer Science (2010)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Computational Mathematics (2012)
First state examination for the teaching degree Realschule Computer Science (2012)
First state examination for the teaching degree Gymnasium Computer Science (2009)

Module title			Abbreviation
Object-oriented Programming			10-I-OOP-102-m01
Module coordinator		**Module offered by**	
Dean of Studies Informatik (Computer Science)		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).	

Contents

Polymorphism, generic programming, meta programming, web programming, templates, document management.

Intended learning outcomes

The students are proficient in the different paradigms of object-oriented programming and have experience in their practical use.

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. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 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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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Mathematics (2012)
Bachelor' degree (1 major) Mathematics (2013)
Bachelor' degree (1 major) Business Information Systems (2013)
Bachelor' degree (1 major) Computational Mathematics (2012)
Bachelor' degree (1 major) Computational Mathematics (2013)
Bachelor' degree (1 major) Aerospace Computer Science (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2011)
Master's degree (1 major) Computer Science (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Computer Architecture			10-I-RAK-102-m01
Module coordinator		**Module offered by**	
Dean of Studies Informatik (Computer Science)		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).	

Contents

Instruction set architectures, command processing through pipelining, statical and dynamic instruction scheduling, caches, vector processors, multi-core processors.

Intended learning outcomes

The students master the most important techniques to design fast computers as well as their interaction with compilers and operating systems.

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. 50 to 60 minutes); if announced by the lecturer by four weeks prior to the examination date, the written examination can be replaced by an oral examination of one candidate each or an oral examination in groups (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 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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Workload

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Teaching cycle

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

§ 69 (1) 1. c) Informatik Technische Informatik

Module appears in

Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Mathematics (2012)
Bachelor' degree (1 major) Mathematics (2013)
Bachelor' degree (1 major) Computational Mathematics (2012)
Bachelor' degree (1 major) Computational Mathematics (2013)
Bachelor' degree (1 major) Aerospace Computer Science (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2011)
Master's degree (1 major) Computer Science (2010)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Applied Analysis			10-M=AAAN-102-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
10	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise 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.	

Contents

In-depth study of functional analysis and operator theory, Sobolev spaces and partial differential equations, theory of Hilbert spaces and Fourier analysis, spectral theory and quantum mechanics, numerical methods (in particular FEM methods), principles of functional analysis, function spaces, embedding theorems, compactness, theory of elliptic, parabolic and hyperbolic partial differential equations with methods from functional analysis.

Recommended previous knowledge:
Familiarity with the contents of the module "Functional Analysis" is strongly recommended.

Intended learning outcomes

The student is acquainted with the fundamental notions, methods and results of higher analysis. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and questions in physics and other natural and engineering sciences.

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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)
Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Complex Analysis			10-M=AFTH-102-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
10	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise 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.	

Contents

In-depth study of mapping properties of analytic functions and their generalisations with modern analytic and geometric methods. Structural properties of families of holomorphic and meromorphic functions. Special functions (e. g. elliptic functions).

Recommended previous knowledge:
Basic knowledge of the contents of the module "Introduction to Complex Analysis" is recommended.

Intended learning outcomes

The student is acquainted with the fundamental notions, methods and results of higher complex analysis, in particular the (geometric) mapping properties of holomorphic functions. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and applications in other subjects.

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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)
Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Groups and their Representations			10-M=VGDS-102-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
10	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise 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.	

Contents

Finite permutation groups and character theory of finite groups, interrelations and special techniques such as the S-rings of Schur.

Recommended previous knowledge:
Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".

Intended learning outcomes

The student masters advanced algebraic concepts and methods. He/She gains the ability to work on contemporary research questions in group theory and representation theory and can apply his/her skills to complex problems.

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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (approx. 90 to 120 minutes; usually chosen), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups of 2 candidates (approx. 30 minutes total)
Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Numeric of Partial Differential Equations			10-M=VNPE-102-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
10	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise 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.	

Contents

Types of partial differential equations, qualitative properties, finite differences, finite elements, error estimates (numerical methods for elliptic, parabolic and hyperbolic partial differential equations; finite elements method, discontinuous Gelerkin finite elements method, finite differences and finite volume methods).

Recommended previous knowledge:
We recommend basic knowledge of functional analysis and partial differential equations, such as can be acquired in the modules "Introduction to Functional Analysis" and "Applied Analysis".

Intended learning outcomes

The student is acquainted with advanced methods for discretising partial differential equations.

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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes)
Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Quantum Control and Quantum Computing			10-M=VQKC-102-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Registration for the exercise must be made via SB@home at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise 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.	

Contents

Basics in dynamics of quantum-mechanical systems (e. g. density operators, observables, Schrödinger equation, Liouville-von-Neumann equation), bilinear control systems in quantum mechanics (e. g. finite-dimensional spin systems and/or infinite-dimensional Schrödinger equations with external control), applications (e. g. in quantum computing or magnetic resonance spectroscopy).

Intended learning outcomes

The student is acquainted with advanced methods in quantum-mechanical control systems. He gains the ability to work on contemporary research questions in and applications of control systems in quantum mechanics.

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)

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)
Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)

Module title			Abbreviation
Numerical Mathematics 1			10-M-NM1-082-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	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.	

Contents

Solution of systems of linear equations and curve fitting problems, nonlinear equations and systems of equations, interpolation with polynomials, splines and trigonometric functions, numerical integration.

Intended learning outcomes

The student is acquainted with the fundamental concepts and methods in numerical mathematics, applies them to practical problems and knows about their typical fields of application.

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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Workload

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Teaching cycle

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

§ 73 (1) 5. Mathematik Angewandte Mathematik

Module appears in

Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Mathematics (2008)
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2009)

Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Physics (2008)
Bachelor' degree (1 major) Technology of Functional Materials (2009)
Bachelor' degree (1 major) Technology of Functional Materials (2010)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Computational Mathematics (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2011)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Functional Materials (2012)
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)
First state examination for the teaching degree Gymnasium Mathematics (2009)

Module title			Abbreviation
Numerical Mathematics 2			10-M-NM2-082-m01
Module coordinator			**Module offered by**
Dean of Studies Mathematik (Mathematics)			Institute of Mathematics
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	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.	

Contents

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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Workload

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Teaching cycle

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

§ 73 (1) 5. Mathematik Angewandte Mathematik

Module appears in

Bachelor' degree (1 major) Mathematics (2008)
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2009)

Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Physics (2008)
Bachelor' degree (1 major) Technology of Functional Materials (2009)
Bachelor' degree (1 major) Technology of Functional Materials (2010)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Computational Mathematics (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2011)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Functional Materials (2012)
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)
First state examination for the teaching degree Gymnasium Mathematics (2009)

Module title			Abbreviation
Operations Research			10-M-ORS-072-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	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.	

Contents

Linear programming, duality theory, transport problems, integral linear programming, graph theoretic problems.

Intended learning outcomes

The student is acquainted with the fundamental methods in operations research, as required as a central tool for solving many practical problems especially in economics. He/She is able to apply these methods to practical problems, both theoretically and numerically.

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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Workload

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Teaching cycle

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

§ 73 (1) 5. Mathematik Angewandte Mathematik

Module appears in

Bachelor' degree (1 major) Computer Science (2007)
Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Mathematics (2008)
Bachelor' degree (1 major) Mathematics (2007)

Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Computational Mathematics (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)
First state examination for the teaching degree Gymnasium Mathematics (2009)

Module title			Abbreviation
Advanced Analysis			10-M-VAN-082-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	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.	

Contents

Lebesgue integral in several variables, including theorems on convergence and Fubini's theorem, L^p-spaces and elementary Fourier theory in L^2, Gauss's theorem.

Intended learning outcomes

The student is acquainted with advanced topics in analysis. Taking the example of the Lesbegue integral, he or she is able to understand the construction of a complex mathematical concept.

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

Ü + 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. 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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Workload

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Teaching cycle

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

§ 73 (1) 1. Mathematik Analysis

Module appears in

Bachelor' degree (1 major) Mathematics (2008)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Computational Mathematics (2009)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)
First state examination for the teaching degree Gymnasium Mathematics (2009)

Module title			Abbreviation
Electronics			11-A2-081-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Principles of passive and active electronic components and their application in analogous and digital circuit technology.

Intended learning outcomes

The students have knowledge of the practical setup of electronic circuits from the field of analogous and digital circuit technology.

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)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2009)
Bachelor' degree (1 major) Physics (2008)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2008)
No final examination Special study offering (2010)

Module title			Abbreviation
Applied Semiconductor Physics			11-AHL-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

The lecture discusses the principles of Semiconductor Physics and provides an exemplary overview of the main components of electronics, optoelectronics and photonics.

Intended learning outcomes

The students know the characteristics of semiconductors, they have gained an overview of the electronic and phonon band structures of important semiconductors and the resulting electronic, optical and thermal properties. They know the principles of charge transport as well as the Poisson, Boltzmann and continuity equation for the solution of questions. They have gained insights into the methods of semiconductor production and are familiar with the theories of planar technology and recent developments in this field, they have a basic understanding of component production. They understand the structure and way of functioning of the main components of electronics (diode, transistor, field-effect transistor, thyristor, diac, triac), of microwave applications (tunnel, Impatt, Baritt or Gunn diode) and of optoelectronics (photo diode, solar cell, light-emitting diode, semiconductor injection laser), they know the realisation possibilities of low-dimensional charge carrier systems on the basis of semiconductors and their technological relevance, they are familiar with current developments in the field of components.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload
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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Reproducing Sensors in Infrared			11-ASI-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	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.	

Contents

Infrared cameras are important experimental and technical tools, e.g. for measuring temperatures. The spectral range of infrared ranges from the visible spectrum, where the Sun is dominating as the natural source of light, up to microwaves and radiowaves with artificial emitters. There is distinct and sometimes dominating emission from bodies with ambient temperature in the infrared spectrum. The lecture provides an introduction to the physical optics of this spectral range and discusses: Peculiarities of infrared cameras and thermal images, different types of sensors (bolometer, quantum well, superlattice) as well as the evaluation of such sensors on the basis of neurophysiological aspects.

Intended learning outcomes

The students have specific and advanced knowledge in the field of infrared spectral imaging. They know various technologies and detector structures as well as their application areas.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Applied Superconduction			11-ASL-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Physical principles of superconductivity. Application in energy engineering. Instrumental developments. Methods of materials sciences for the calculation of temperature profiles in superconductors.

Intended learning outcomes

The students have a basic understanding of superconductivity as a macroscopic quantum phenomenon. They are able to evaluate the contributions of materials sciences to the development of superconductivity. They are able to discuss questions on superconductivity in a scientific manner and to critically question developments of energy technology. Furthermore, they can deal with practical mathematical questions.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: once a year, winter semester
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Imaging Methods at the Synchrotron			11-BMS-121-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Overview of synchrotron radiation and its generation. - Principles of the interaction between radiation and matter. - Principles of X-ray optics, X-ray lens. - Synchroton detector technique X-ray diffractometry (diffraction) of crystalline materials.

Intended learning outcomes

The students have advanced knowledge of synchrotron radiation and X-ray optics. They know the physical principles of imaging techniques at the synchrotron and their application for crystalline materials and other materials. They understand the principles of image generation and are able to explain different techniques and interpret simple images.

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

V + R (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)

a) written examination (90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Imaging Methods at the Synchrotron			11-BMS-131-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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 semesters.	

Contents

Overview of synchrotron radiation and its generation. - Principles of the interaction between radiation and matter. - Principles of X-ray optics, X-ray lens. - Synchroton detector technique X-ray diffractometry (diffraction) of crystalline materials.

Intended learning outcomes

The students have advanced knowledge of synchrotron radiation and X-ray optics. They know the physical principles of imaging techniques at the synchrotron and their application for crystalline materials and other materials. They understand the principles of image generation and are able to explain different techniques and interpret simple images.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)

Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Biophysical Measurement Technology in Medical Science			11-BMT-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

The lecture covers the physical principles of imaging techniques and their application in Biomedicine. The main topics are conventional X-ray technique, computer tomography, imaging techniques of nuclear medicine, ultrasound and MR-tomography. The lecture additionally addresses systems theory of imaging systems and digital image processing.

Intended learning outcomes

The students know the physical principles of imaging techniques and their application in Biomedicine. They understand the principles of image generation and are able to explain different techniques and interpret simple images.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Image and Signal Processing in Physics			11-BSV-122-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Periodic and aperiodic signals; principles of discreet and exact Fourier transformation; principles of digital signal and image processing; discretisation of signals/sampling theorem (Shannon); homogeneous and linear filters, convolution product; tapering functions and interpolation of images; the Parsival theorem, correlation and energetic observation; statistical signals, image noise, moments, stationary signals; tomography: Hankel and Radon transformation.

Intended learning outcomes

The students have advanced knowledge of digital image and signal processing. They know the physical principles of image processing and are familiar with different methods of signal processing. They are able to explain different methods and to implement them, especially in the field of tomography.

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

V + R (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)

a) written examination (90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Image and Signal Processing in Physics			11-BSV-131-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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 semesters.	

Contents

Periodic and aperiodic signals; principles of discreet and exact Fourier transformation; principles of digital signal and image processing; discretisation of signals/sampling theorem (Shannon); homogeneous and linear filters, convolution product; tapering functions and interpolation of images; the Parsival theorem, correlation and energetic observation; statistical signals, image noise, moments, stationary signals; tomography: Hankel and Radon transformation.

Intended learning outcomes

The students have advanced knowledge of digital image and signal processing. They know the physical principles of image processing and are familiar with different methods of signal processing. They are able to explain different methods and to implement them, especially in the field of tomography.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Computational Materials Science			11-CMS-122-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Density functional theory (DFT)/local-density approximation (exercise with "Wien2k"; band structure programme, Green's functions, quantum dots, Anderson impurity model (exercise, implementation of the exact diagonalisation/Lanczos), introduction to continuous-time quantum Monte Carlo (exercise), crystal field symmetry, Coulomb interaction, dynamic mean field theory (DMFT exercise). Lecture + 4-5 exercises in the CIP pool. The exercises implement the basic ideas of different algorithms, either based on template programmes or on completely self-written programmes. Electronic submission of all exercises and approx. 20 minutes presentation about one of the 4-5 topics of the lecture/exercise (freely chosen by the student) with a little more elaboration on the topic than in the exercise.

Intended learning outcomes

Theoretical treatment of the above topics complemented by hands-on tutorials to be held in the CIP-Pool. Familiarity with DFT software packages such as VASP or Wien2k and and construction of maximally localized Wannier functions by projecting DFT results onto atomic orbitals using wannier90. Focus on applications to topological materials. Knowledge how to obtain many-body solutions of the AIM and explore some of its limiting cases such as the Kondo regime. Ability to use impurity solvers based on exact diagonalization or continuous-time quantum Monte Carlo for the solution of the DMFT self-consistency equations.

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

V + R (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)

a) written examination (90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German or English

Allocation of places

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Additional information

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Workload
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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Computational Materials Science			11-CMS-131-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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 semesters.	

Contents

Density functional theory (DFT)/local-density approximation (exercise with "Wien2k"; band structure programme, Green's functions, quantum dots, Anderson impurity model (exercise, implementation of the exact diagonalisation/Lanczos), introduction to continuous-time quantum Monte Carlo (exercise), crystal field symmetry, Coulomb interaction, dynamic mean field theory (DMFT exercise). Lecture + 4-5 exercises in the CIP pool. The exercises implement the basic ideas of different algorithms, either based on template programmes or on completely self-written programmes. Electronic submission of all exercises and approx. 20 minutes presentation about one of the 4-5 topics of the lecture/exercise (freely chosen by the student) with a little more elaboration on the topic than in the exercise.

Intended learning outcomes

The students have advanced knowledge of mathematical methods of material sciences. They are able to develop algorithms for the application of these methods and to implement them into programmes.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Density Functional Theory and the Physics of Oxide Heterostructure			11-DFT-142-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

The students are familiar with the physical values of oxide heterostructures and with the principles and methods of density functional theory. They are able to model problems of Theoretical Physics with the help of important programmes such as Wien2k or VASP. They can make simple calculations with the help of density functional theory.

Intended learning outcomes

The students are familiar with the physical values of oxide heterostructures and with the principles and methods of density functional theory. They are able to model problems of Theoretical Physics with the help of important programmes such as Wien2k or VASP. They can make simple calculations with the help of density functional theory.

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

V + D (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)

a) written examination (90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: approx. 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Principles of Image Processing			11-EBV-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	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.	

Contents

Introduction to image processing. Pictures as two-dimensional signals; digitalisation. Two-dimensional Fourier transform. Histogram equalisation (e.g. image brightening) and pixel connectivity (e.g. noise reduction). Automatic image recognition: Segmentation, classification. Technological image generation. Applications (e.g. motion tracking). Three-dimensional images.

Intended learning outcomes

The students have specific and advanced knowledge in the field of image processing. They know the principles and theory of signal processing for images and have corresponding knowledge of image generation. They are able to independently work with literature, they understand the characteristics of image processing with commercial software and are able to process images for the analysis of experiments with imaging measuring methods.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Electron Electron Interaction			11-EEW-102-m01
Module coordinator			**Module offered by**
Managing Director of the Institute of Theoretical Physics and Astrophysics			Faculty of Physics and Astronomy
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

1. Introduction, systems, Landau theory2. Interacting electron gas. 3. One-dimensional electron gas (without interaction). 4. Introduction to boson phase fields and interactions. 5. Calculation of correlation functions. 6. Method of functional integrals. 7. Renormalisation groups.8. Consideration of spin. 9. One-dimensional lattice models. 10. Impurities in Luttinger liquids

Intended learning outcomes

The students know the principles of the theoretical description of electron-electron interactions in one dimension.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Principles of Energy Technologies			11-ENT-092-m01
Module coordinator			**Module offered by**
Managing Director of the Institute of Applied Physics			Faculty of Physics and Astronomy
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Physical principles of energy conservation and energy conversion, energy transport and energy storage as well as renewable resources of energy. We also discuss aspects of optimising materials (e.g. nanostructured insulating 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 converters. Nuclear power plants. Hydroelectricity. Wind turbines. Photovoltaics. Solar thermal: Heat. Solar thermal: Electricity. Biomass. Geothermal energy. Energy storage. Energy transport

Intended learning 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.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Introduction to Plasmaphysics			11-EPP-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Plasma Astrophysics: Dynamics of charged particles in electric and magnetic fields, Magnetohydrodynamics, Transport equations for energetic particles, Properties of magnetic turbulence, Propagation of solar particles within the solar wind, Particle acceleration via shock waves and via interaction with plasma turbulence, Particle acceleration and transport in galaxies and other astrophysical objects, Cosmic radiation.

Intended learning outcomes

The students know the principles of Plasma Physics, especially the description of transport phenomena in plasma. They are able to solve basic problems of Plasma Physics and to apply this knowledge to Astrophysics.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Current Topics in Nanostructure Technology			11-EXN5-111-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Current topics of Experimental Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.

Intended learning outcomes

The students have advanced competencies corresponding to the requirements of a module of Nanostructure Technology of the Master's programme. They have knowledge of a current subdiscipline of nanostructure technology or nano sciences and understand the measuring and evaluation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.

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

V + R (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)

a) written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Current Topics in Nanostructure Technology			11-EXN6-111-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Current topics of Experimental Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.

Intended learning outcomes

The students have advanced competencies corresponding to the requirements of a module of Nanostructure Technology of the Master's programme. They have knowledge of a current subdiscipline of nanostructure technology or nano sciences and understand the measuring and evaluation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.

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

V + R (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)

a) written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Current Topics in Nanostructure Technology			11-EXN7-111-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
7	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Current topics of Experimental Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.

Intended learning outcomes

The students have advanced competencies corresponding to the requirements of a module of Nanostructure Technology of the Master's programme. They have knowledge of a current subdiscipline of nanostructure technology or nano sciences and understand the measuring and evaluation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.

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

V + R (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)

a) written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Current Topics in Nanostructure Technology			11-EXN8-111-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Current topics of Experimental Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.

Intended learning outcomes

The students have advanced competencies corresponding to the requirements of a module of Nanostructure Technology of the Master's programme. They have knowledge of a current subdiscipline of nanostructure technology or nano sciences and understand the measuring and evaluation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.

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

V + R (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)

a) written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Non-technical Minor Subject			11-EXNT6-112-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Non-technical minor. Accredited academic achievements, e.g. in case of change of university or study abroad.

Intended learning outcomes

The students have advanced competencies on the Master's level which correspond to the requirements of a module in the field of a non-technical minor (mathematics, chemistry, informatics, law, business sciences...).

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

V + R (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)

a) written examination (approx. 120 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Current Topics in Physics			11-EXP5-111-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Current topics of Experimental and Theoretical Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.

Intended learning outcomes

The students have advanced competencies corresponding to the requirements of a module of Experimental or Theoretical Physics of the Master's programme of Nanostructure Technology. They have knowledge of a current subdiscipline of Physics and understand the measuring and/or calculation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.

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

V + R (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)

a) written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Current Topics in Physics			11-EXP6-111-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Current topics of Experimental and Theoretical Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.

Intended learning outcomes

The students have advanced competencies corresponding to the requirements of a module of Experimental or Theoretical Physics of the Master's programme of Nanostructure Technology. They have knowledge of a current subdiscipline of Physics and understand the measuring and/or calculation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.

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

V + R (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)

a) written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Current Topics in Physics			11-EXP7-111-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
7	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Current topics of Experimental and Theoretical Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.

Intended learning outcomes

The students have advanced competencies corresponding to the requirements of a module of Experimental or Theoretical Physics of the Master's programme of Nanostructure Technology. They have knowledge of a current subdiscipline of Physics and understand the measuring and/or calculation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.

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

V + R (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)

a) written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Current Topics in Physics			11-EXP8-111-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Current topics of Experimental and Theoretical Physics. Accredited academic achievements, e.g. in case of change of university or study abroad.

Intended learning outcomes

The students have advanced competencies corresponding to the requirements of a module of Experimental or Theoretical Physics of the Master's programme of Nanostructure Technology. They have knowledge of a current subdiscipline of Physics and understand the measuring and/or calculation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.

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

V + R (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)

a) written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Additional Qualifications for Engineers			11-EXZ5-111-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Additional skills for engineers. Accredited academic achievements, e.g. in case of change of university or study abroad

Intended learning outcomes

The students have advanced competencies corresponding to the requirements of a module of the Master's degree programme of Nanostructure Technology. They have qualifying knowledge for an occupation in the industry or industrial research.

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

V + R (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)

a) written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Additional Qualifications for Engineers			11-EXZ6-111-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Additional skills for engineers. Accredited academic achievements, e.g. in case of change of university or study abroad

Intended learning outcomes

The students have advanced competencies corresponding to the requirements of a module of the Master's degree programme of Nanostructure Technology. They have qualifying knowledge for an occupation in the industry or industrial research.

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

V + R (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)

a) written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Solid State Physics 2			11-FK2-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Advanced Solid-State Physics. Electrons in periodic potential - the band structure. Dynamics in the semi-classical model. Dielectric properties and ferroelectrics. Semiconductors. Magnetism. Superconductivity. Coupled excitations and optical properties [optional]

Intended learning outcomes

The students have specific and advanced knowledge in the field of Solid-State Physics. They are theoretically able to specialise in a sub-discipline of Solid-State Physics.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Solid State Spectroscopy			11-FKS-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Single- and many-particle picture of electrons in solids. Light-matter interaction. Optical spectroscopy. Electron spectroscopy. X-ray spectroscopies.

Intended learning outcomes

The students have specific and advanced knowledge in the field of solid-state spectroscopy. They know different types of spectroscopy and their fields of application. They understand the theoretical principles and the current developments in research.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Solid State Spectroscopy 2			11-FKS2-132-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Modern scattering methods; neutron scattering as a method to investigate the atomic and magnetic structure and excitations such as phonons and magnetic waves; resonant elastic X-ray scattering and absorption; investigation of magnetic, orbital and charge order; X-ray and neutron reflectometry; investigation of the structural, magnetic and electronic properties of thin films and superlattices; resonant inelastic X-ray scattering; investigation of excitations in solids and thin films; STEM ("scanning transmission electron microscopy"); further topics upon agreement.

Intended learning outcomes

The students know different modern scattering methods such as neutron scattering, resonant elastic X-ray scattering, modern scattering theory, X-ray and neutron reflectometry and resonant inelastic X-ray scattering. They are familiar with the theoretical principles and applications of these methods.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title	Abbreviation
Transport Phenomena in Solids	11-FKT-092-m01

Module coordinator	Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics	Faculty of Physics and Astronomy

ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	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.

Contents

Transport phenomena in solids.

Intended learning outcomes

The students have specific and advanced knowledge in the field of transport phenomena in solids.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)

Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Visiting Research Project			11-FPA-112-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
10	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Approval by examination committee required.	

Contents

Independent work on a current research topic of Experimental and Theoretical Physics. Implementation of scientific experiments including analysis and documentation of the results, especially in the context of research visits to other universities or research institutes.

Intended learning outcomes

The students are able to independently work on a current research area of Experimental or Theoretical Physics, to conduct and analyse scientific experiments and to document the results.

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

R (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 report (approx. 10 to 20 pages)
Language of assessment: German, English

Allocation of places

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Additional information

Additional information on module duration: 1 to 2 semesters.

Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Professional Specialization Nanostructure Technology			11-FS-N-072-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
15	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Introduction to current experimental or theoretical questions of a subdiscipline of nanostructure technology with special relevance to the planned topic of the Master's thesis. Summary of the required fundamental topics in a seminar presentation.

Intended learning outcomes

The students have advanced scientific knowledge of the principles of a current experimental, theoretical or engineering subdiscipline of nanostructure technology with special relevance to the intended topic of the Master's thesis and are able to summarise their knowledge in an oral presentation.

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

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)

talk (approx. 30 to 45 minutes) with discussion

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Field Theory in Solid State Physics			11-FTFK-112-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

This will usually be a course on quantum many particle physics using the method of functional integration. An outline could be:
1 Coherent states and review of second quantization
2 The functional integral formalism at finite temperatures T
3 Perturbation theory at T=0
4 Order parameters and broken symmetry
5 Green's functions
6 The Landau theory of Fermi liquids
7 Further developments

Intended learning outcomes

The students have mastered the principles of quantum field theory in many-particle systems. They are able to apply the acquired methods to current problems of Theoretical Solid-State Physics.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Semiconductor Lasers - Principles and Current Research			11-HLF-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

This lecture discusses the principles of laser physics, based on the example of semiconductor lasers, and current developments regarding components. The principles of lasers are described on the basis of a general laser model, which will then be extended to special aspects of semiconductor lasers. Basic concepts such as threshold condition, characteristic curve and laser efficiency are derived from coupled rate equations for charge carriers and photons. Other topics of the lecture are optical processes in semiconductors, layer and ridge waveguides, laser resonators, mode selection, dynamic properties as well as technology for the generation of semiconductor lasers. The lecture closes with current topics of laser research such as quantum dot lasers, quantum cascade lasers, terahertz lasers or high-performance lasers.

Intended learning outcomes

The students have advanced knowledge of the principles of semiconductor-laser physics. They can apply their knowledge to modern questions and know the applications in the current development of components.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012) Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Semiconductor Physics			11-HLP-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Advanced examination of crystal bonding and the electronic band structure of semiconductors. Optical excitations and their coupling effects. Electron-phonon coupling. Temperature-dependent transport properties. Quantisation effects of semiconductors with reduced dimensions. (Semi-)magnetic semiconductors.

Intended learning outcomes

The students have specific and advanced knowledge in the field of Semiconductor Physics. They know the physical principles of semiconductors and have gained an overview of the important characteristics of semiconductor materials.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Semiconductor Nanostructures			11-HNS-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Semiconductor nanostructures are frequently referred to as "artificial materials". In contrast to atoms, molecules or macroscopic crystals, their electronic, optical and magnetic properties can be systematically tailored by changing their size. The lecture addresses technological challenges in the preparation of semiconductor nanostructures of varying dimensions (2D, 1D, 0D). It provides the basic theoretical concepts to describe their properties, with a focus on optical properties and light-matter coupling. Moreover, it discusses the challenges and concepts of novel optoelectronic and quantum photonic devices based on such nanostructures, including building blocks for quantum communication and quantum computing architectures.

Intended learning outcomes

The students know the theoretical principles and characteristics of semiconductor nanostructures. They have knowledge of the technological methods to fabricate such structures, and of their applications to novel photonic devices. They are able to apply their knowledge to problems in this field of research.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Technology of Functional Materials (2010) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012) Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Introduction to Electron Microscopy			11-IEM-111-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

1. Microscopy with light and electrons. 2. Electrons and their interaction with a specimen. 3. Electron diffraction (selected-area ED, convergent beam ED, basics of electron crystallography, comparison with the X-ray diffraction technique). 4. Transmission electron microscopy (the instrument, contrast mechanisms, principles of image formation, imaging of microstructure). 5. Can we see atoms? High-resolution electron microscopy (principle of image formation, image simulation). 6. Scanning electron microscopy (the instrument, contrast mechanisms). 7. Chemical analysis with the electron microscope (energy-dispersive X-ray microanalysis, electron energy loss spectroscopy). 8. Sample preparation. Electron microscopy and complementary techniques.

Intended learning outcomes

The students have basic knowledge of modern research methods of electron microscopy up to an atomic level. They know microscoping procedures that are used in practice in labs and the industry as well as electron-microscopic methods for chemical analysis. They are able to evaluate the efficiency of different research methods.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Functional Materials (2012) Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Principles of Classification of Patterns			11-KVM-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	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.	

Contents

Signals such as images, but also acoustic records, spectra, electrical measurements often contain recurring patterns. These patterns are often classified and analysed by observers, e.g. by a doctor when analysing an ECG. More and more automatic procedures are adopted to take on these tasks and classify patterns. The lecture will discuss principles of different classifiers such as "minimum distance" and "maximum likelihood".

Intended learning outcomes

The students have specific and advanced knowledge in the field of pattern recognition. They know methods of classifying patterns in measuring data as well as ways to automatise these processes. They are able to apply these methods to practical problems.

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

V + R (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)

a) written examination (90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Lithography in Semiconductor Technology and Theory of Quantum Transport			11-LHQ-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Introduction to the lithographic techniques of semiconductor technology and discussion of the required theory on quantum transport.

Intended learning outcomes

The students have specific and advanced knowledge of semiconductor lithography and of the theory of quantum transport.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Laboratory and Measurement Technology in Biophysics			11-LMB-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

The lecture covers relevant principles of molecular and cellular biology as well as the physical principles of biophysical procedures for the examination and manipulation of biological systems. The main topics are optical measuring techniques and sensors, methods of single-particle detection, special microscoping techniques and methods of structure elucidation of biomolecules.

Intended learning outcomes

The students know the principles of molecular and cellular biology as well as the physical principles of biophysical procedures for the examination and manipulation of biological systems. They have knowledge of optical measuring techniques and their applications and are able to apply techniques of structure elucidation to simple biomolecules.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Introduction to LabVIEW			11-LVW-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

The module comprises basic and advanced courses. The basic course "NI LabVIEW Basic 1" is the first level of each LabVIEW learning phase. LabVIEW Basic provides a systematic introduction to the functions and application fields of the development environment of LabVIEW. The students become acquainted with dataflow programming and with common LabVIEW architectures. They learn to develop LabVIEW applications for various application fields, from assessment and measurement applications up to data collection, device control, data recording and measurement analysis. In the advanced course "NI LabVIEW Core 2", the students learn to develop comprehensive standalone applications, including the graphical development environment LabVIEW. The course builds upon LabVIEW Basic 1 and provides an introduction to the most common development technologies, in order to enable the students to successfully implement and distribute LabVIEW applications for different application fields. Course topics include techniques and procedures for the optimisation of application performance, e.g. through an optimised reuse of existing codes, usage of file I/O functions, principles of data management, event computing and methods of error handling. After finishing the course, the students have the ability to apply LabVIEW functions according to individual requirements, which enables a fast and productive application development.

Intended learning outcomes

The students have specific and advanced knowledge in the application field of LabVIEW. They know the principles of working with LabVIEW and are able to develop applications, e.g. for recording and analysing measuring data.

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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) or e) project (approx. 60 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information
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Workload
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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Magnetism			11-MAG-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Dia- and paramagnetism, exchange interaction, ferromagnetism, antiferromagnetism, anisotropy, domain structure, nanomagnetism, superparamagnetism, experimental methods to measure magnetic properties, Kondo effect.

Intended learning outcomes

The students know basic terms, concepts and phenomena of magnetism and measuring methods for magnetic experiments; they are skilled in simple model building and in the formulation of mathematical-physical approaches and are able to apply them to tasks in the stated areas; they have competencies in independently working on problems of these areas; they are able to evaluate the accuracy of observations and analyses.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Master Thesis Nanostructure Technology			11-MA-N-072-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
30	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Registration for assessment to be carried out electronically. Deadlines will be announced separately. Please consult with your supervisor.	

Contents

Mostly independent processing of an experimental, theoretical or engineering task in the field of nanostructure technology, especially according to known procedures and scientific aspects; writing of the thesis.

Intended learning outcomes

The students are able to independently work on an experimental, theoretical and engineering task from nanostructure technology, especially in accordance with known methods and scientific aspects and to summarise their results in a final paper.

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

no courses assigned

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 thesis (approx. 75 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Opto-electronic Material Properties			11-MOE-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Admission prerequisite to assessment: successful completion of approx. 50% of exercises. 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.	

Contents

Physical principles of optoelectronic material properties and applications.

Intended learning outcomes

The students know the principles of optoelectronic material characteristics.

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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Scientific Methods and Project Management Nanostructure Technology			11-MP-N-072-m01
Module coordinator		**Module offered by**	
chairperson of examination committee		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
15	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Introduction to the methods of scientific work, taking into account methods of project planning. Application to theoretical, experimental or engineering questions of nanostructure technology. Writing of a scientific project plan for the planned Master's thesis.

Intended learning outcomes

The students have knowledge of the scientific methods, the methodological work and the methods of project planning of a current experimental, theoretical or engineering subdiscipline of nanostructure technology with special relevance to the intended topic of the Master's thesis and are able to develop a project plan for the Master's thesis, to plan the required work and to summarise their knowledge in an oral presentation.

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

R (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)

talk (approx. 30 to 45 minutes) with discussion

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Methods in Surface Spectroscopy			11-MSS-102-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Boundary conditions of experiments: Ultra-high vacuum, surface sensibility, light-matter-interaction, principles of photoelectron spectroscopy (PES), one-particle image of PES, three step model, many-particle effects, line shape, satellites, Fermi liquid, quasiparticles, exemplary systems and spectra, measurements with synchrotron radiation, related experimental methods.

Intended learning outcomes

The students know the physical principles and experimental methods of surface spectroscopy. They are able to conduct, evaluate and interpret simple measurements.

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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Magnetism and Spin Transport			11-MST-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
2 semester	graduate	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.	

Contents

The module spans two semesters. During the winter semester, the students become acquainted with the principles of magnetism (ranging from atoms to solids), properties of magnetic material (individual usage) and methods to characterise magnetic properties. During the summer semester, the students learn about spin transport in metallic systems in due consideration of giant magnetoresistance and tunnel magnetoresistance and its application in magnetic memory. As a last point, we discuss new phenomena from the field of spin dynamics and current-induced spin phenomena.

Intended learning outcomes

The students know the basic terms, concepts and phenomena of magnetism and measuring methods for magnetic experiments; they are familiar with spin transport applications of information technologies and have gained an overview of modern findings in this area (GMR, TMR). They are skilled in simple model building and in the formulation of mathematical-physical approaches and are able to apply them to tasks in the stated areas.

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

V + R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Nanoanalytics			11-NAN-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Principles of analytic procedures in the field of nanostructure physics, imaging techniques from a microscopic level up to an atomic level, examination of chemical composition, spectroscopy of electronic properties, usage of X-ray methods. - Physics and material systems on the nanoscale. - Scanning probes: Atomic force microscopy. Scanning tunneling microscopy. - Electron probes: Scanning electron microscope. Transmission electron microscope. - Secondary ions - mass spectrometry - X-ray methods: Synchrotron spectroscopy. Photoemission. X-ray absorption

Intended learning outcomes

The students have basic knowledge of modern research methods for different nanostructures up to an atomic level. They know microscoping procedures that are used in practice in labs and the industry as well as spectroscopic methods for the determination of electronic properties. They are able to evaluate the efficiency of different research methods.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Low-Dimensional Structures			11-NDS-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Low-dimensional structures: Crystal lattice symmetry. Lattice dynamics and growth techniques of low-dimensional structures. Comparison between these structures and volume solids. X-ray diffractometry. Molecular beam epitaxy.

Intended learning outcomes

The students have knowledge of the theoretical principles of the growth of low dimensional structures. They know methods of producing and analysing such structures. They know the bandstructures of the most important semiconductors as well as the fabrication and characteristics of semiconductor heterostructures and MOS-diodes. They are familiar with the subband structure of semiconductor heterostructures and MOS-diodes and can evaluate the importance of many-particle effects. They are able to solve problems related to potentials in one dimension by applying Poisson's equation. They know the k*p perturbation theory and can deduce the 2D subband structure from the bulk band structure. They have knowledge of the meaning of modulation doping and are familiar with the 2D hydrogen atom. They understand how an external magnetic field acts on the properties of a free electron gas in 2D. They have basic knowledge of the meaning of gauging, Landau-quantisation, filling factor and Landau degeneracy. They understand the dependence of various physical properties on the filling factor, and are able to solve implicit problems via numerical methods. They are familiar with elementary excitations in two-dimensional systems.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information
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Workload
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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Nanoelectronics			11-NEL-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

The lecture and the corresponding exercises convey basic concepts of electronics of nanostructures. First, we discuss terms such as Fermi distribution, density of states and carrier concentration in view of small structures. Afterwards, we talk about application potentials of nanostructures in electronics. We examine the limits of the function of common switches and storages through miniaturisation and compare them to electronic properties of nanostructures. We gain an overview of nanoelectric amplifiers, rectifier, logic lattices and circuits and discuss the operating principle of quantum computers.

Intended learning outcomes

The students have mastered the basics of electronics of nanostructures in theory and practice. They know functions and applications of respective components.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010)

Module title			Abbreviation
Nanomatrix Biophysical Analyzing Systems and Processes (Master)			11-NM-BV-MA-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Principles and specific knowledge of engineering work in the application fields of energy engineering, electronics, photonics and biophysics as well as in the technology-oriented materials sciences, technologies of nanostructuring, components and system development, especially in the field of biophysical analysis systems and procedures.

Intended learning outcomes

The students have advanced knowledge of one or more application or technology areas of engineering work, especially in the field of biophysical analysis systems and techniques.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Nanomatrix Semiconductor Materials (Master)			11-NM-HM-MA-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Principles and specific knowledge of engineering work in the application fields of energy engineering, electronics, photonics and biophysics as well as in the technology-oriented materials sciences, technologies of nanostructuring, components and system development, especially in the field of semiconductor materials.

Intended learning outcomes

The students have advanced knowledge of one or more application or technology areas of engineering work, especially in the field of semiconductor materials.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Nanomatrix Semiconductor Processing (Master)			11-NM-HP-MA-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Principles and specific knowledge of engineering work in the application fields of energy engineering, electronics, photonics and biophysics as well as in the technology-oriented materials sciences, technologies of nanostructuring, components and system development, especially in the field of semiconductor processes.

Intended learning outcomes

The students have advanced knowledge of one or more application or technology areas of engineering work, especially in the field of semiconductor processes.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Nanomatrix Micro/Nano- and Optoelectronic Devices (Master)			11-NM-MB-MA-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Principles and specific knowledge of engineering work in the application fields of energy engineering, electronics, photonics and biophysics as well as in the technology-oriented materials sciences, technologies of nanostructuring, components and system development, especially in the field of micro-/nano- and opto-electronic components.

Intended learning outcomes

The students have advanced knowledge of one or more application or technology areas of engineering work, especially in the field of micro-, nano- and optoelectronic components.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Nanomatrix Heat Insulating Systems and Photovoltaics			11-NM-WP-MA-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Principles and specific knowledge of engineering work in the application fields of energy engineering, electronics, photonics and biophysics as well as in the technology-oriented materials sciences, technologies of nanostructuring, components and system development, especially in the field of thermal insulation systems and photovoltaics.

Intended learning outcomes

The students have advanced knowledge of one or more application or technology areas of engineering work, especially in the field of thermal insulation systems and photovoltaics.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Nano-Optics			11-NOP-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Theoretical principles. Focussing of light. Microscopy. Optical nearfield probes. Nearfield microscopy. Single quantum emitters. Light emission in nano-tailored environments. Plasmons. Optical antennas.

Intended learning outcomes

The students have specific and advanced knowledge in the field of nano-optics. They are familiar with the theoretical principles and application areas of nano-optics and with current developments in this field.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Nanotechnology in Energy Research			11-NTE-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Nanotechnology is of great significance for energy research. Energy efficiency can be heightened in numerous processes or applications by using special functional materials. This module covers special materials, surfaces and structures that have optimised properties due to effects of nanotechnology. It explains the underlying physical contexts. It uses specific materials and components as examples, such as thermal insulation materials, heat accumulators, functional nanoscale layer and particle systems with spectral selective properties, nanoporous vacuum insulations and electrode materials.

Intended learning outcomes

The students have specific and advanced knowledge of the application of nanotechnology in the field of energy research. They know methods of nanotechnology to influence the properties of materials and their applications. They are able to apply their knowledge to specific questions.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Organic Semiconductor			11-OHL-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Admission prerequisite to assessment: successful completion of approx. 50% of exercises. 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.	

Contents

Physical principles of organic semiconductors, molecular and polymer electronics and sensor technology, applications.

Intended learning outcomes

The students have advanced knowledge of organic semiconductors.

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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Advanced Practical Course Master			11-PFM-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	(not) successfully completed	11-E1, 11-E2	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	11-A3	

Contents

Principles of Nuclear, Atomic and Molecular Physics, experiments on cryogenic temperatures and correlated systems, properties of solids, surfaces and interfaces. Experiments on the following topics: X-rays - nuclear magnetic resonance (NMR) - quantum Hall effect - optical pumping and spectroscopy in the field of optics - Hall effect - superconductivity - laser - solid-state optics

Intended learning outcomes

Knowledge of conducting experiments, analysing and documenting experimental results, basic knowledge of issuing scientific publications, application of modern evaluation systems, working on a task based on publications and acquiring practical experimental methods.

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

Fortgeschrittenen-Praktikum Master (Advanced Practical Course Master) Part 1: P (3 weekly contact hours), German or English
Fortgeschrittenen-Praktikum Master (Advanced Practical Course Master) Part 2: P (3 weekly contact hours), German or English

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

This module has the following assessment components
1. Lab course in part 1 (Fortgeschrittenen-Praktikum Master/Advanced Practical Course Master Part 1): a) Preparing the experiment will be considered successfully completed if an oral test (approx. 30 minutes) is passed prior to the experiment. b) Performing and evaluating the experiment will be considered successfully completed if a test is passed. Students must prepare an experiment log (approx. 8 pages).
2. Lab course in part 2 (Fortgeschrittenen-Praktikum Master/Advanced Practical Course Master Part 2): a) Preparing the experiment will be considered successfully completed if an oral test (approx. 30 minutes) is passed prior to the experiment. b) Performing and evaluating the experiment will be considered successfully completed if a test is passed. Students must prepare an experiment log (approx. 8 pages).

Language of assessment: German or English
Students must register for assessment components 1 and 2 online (details to be announced).
Students will be offered one opportunity to retake element a) and/or element b) in the respective semester. To pass an assessment component, they must pass both elements (a and b) in the same semester.
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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Workload

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Teaching cycle

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

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Module appears in
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title	Abbreviation
Physics of Complex Systems	11-PKS-092-m01

Module coordinator	Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics	Faculty of Physics and Astronomy

ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	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.

Contents

1. Theory of critical phenomena in thermal equilibriumt
2. Introduction into the physics out of equilibriumt
3. Entropy production and fluctuationst
4. Phase transitions away from equilibriumt
5. Universalityt
6. Spin glassest
7. Theory of neural networks

Intended learning outcomes

The students have specific and advanced knowledge in the field of physics of complex systems. They know the methods of Statistical Physics, Computational Physics and non-linear dynamics, which are used to describe such systems. They are able to work on current research problems in this area.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Physics of Advanced Materials			11-PMM-132-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

General properties of various material groups such as liquids, liquid crystals and polymers; magnetic materials and superconductors; thin films, heterostructures and superlattices. Methods of characterising these material groups; two-dimensional layer materials.

Intended learning outcomes

The students know the properties and characterising methods of some modern materials.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Quantum Information and Quantum Computing			11-QIC-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

The first part introduces the theoretical concepts of quantum information and quantum computers. It discusses the main quantum algorithms. The second part discusses experimental possibilities for the realisation of entangled states. One of the main topics is the production, controlling and manipulation of coherent two-electron spin states. The third part covers the description and explanation of decoherence of quantum mechanical states.

Intended learning outcomes

The students have an advanced understanding of quantum theory and basic knowledge of quantum calculation. They are able to solve simple problems of quantum information theory.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Quantum Mechanics II			11-QM2-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	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.	

Contents

"Quantum mechanics II" constitutes the central theoretical course of the international Master's program in Physics. It builds upon basics which are acquired in the lecture "Quantum mechanics I" of the Bachelor's degree. While the specific emphasis can be adjusted individually, the core topics that are supposed to be covered should include:
1. Second quantisation: Fermions and bosons
2. Band structures of particles in a crystal
3. Angular momentum, symmetry operators, Lie Algebras
4. Scattering theory: Potential scattering, partial wave expansion
5. Relativistic quantum mechanics: Klein-Gordon equation, Dirac equation, Loretz group, fine structure splitting of atomic spectra
6. Quantum entanglement
7. Canonical formalism

Intended learning outcomes

The students acquire in-depth knowledge of advanced quantum mechanics and have a thorough understanding of the mathematical and theoretical concepts of the listed topics. They are able to describe or model problems of modern theoretical Quantum Physics mathematically, to solve problems analytically, to use approximation methods and to interpret the results physically. The course is pivotal to subsequent theory courses in Astrophysics, High-Energy Physics and Condensed Matter/Solid-State Physics. The course is mandatory for all Master's students.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places
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Additional information
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Workload
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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Quantum Phenomena in electronic correlated Materials			11-QPM-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Quantum effects and phenomena in current solid-state research. Correlations. Free electron gas and Fermi liquid. Strongly correlated systems

Intended learning outcomes

The students have specific, advanced knowledge of the current research on Solid-State Physics, especially on quantum effects in strongly correlated systems. They are able to understand the connections between the theoretical description of such systems and the current experimental results.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Quantum Information Technology			11-QUI-132-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Basic concepts of quantum mechanics, quantum bits and algorithms, quantal measurements, experimental approaches towards quantum computing (on the basis of photons, ions and nuclear spins), quantum operations and quantum noise, quantum information and communication.

Intended learning outcomes

The students are familiar with the basic quantum mechanical terms of quantum information technology. They know experimental approaches for the realisation of quantum computers and for the transfer of quantum information.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title	Abbreviation
Many Body Quantum Theory	11-QVTP-092-m01

Module coordinator	Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics	Faculty of Physics and Astronomy

ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	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.

Contents

This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions.
An outline could be:

1 Single-particle Green's function
2 Review of second quantization
3 Diagrammatic method using many particle Green's functions at temperature T=0
4 Diagrammatic method for finite T
5 Landau theory of Fermi liquids
6 Superconductivity
7 One-dimensional systems and bosonization

Intended learning outcomes

The students have mastered the principles of quantum field theory in many-particle systems. They are able to apply the acquired methods to current problems of Theoretical Solid-State Physics.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload
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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011)

Module title	Abbreviation
Renormalization Group Methods in Field Theory	11-RMFT-102-m01

Module coordinator	Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics	Faculty of Physics and Astronomy

ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	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.

Contents

Renormalisation group methods for non-linear partial differential equations, field theoretical contexts and non-analysed behaviour of cryogenic temperatures.

Intended learning outcomes

The students gain an overview of non-linearities in partial differential equations and their solution on the basis of the renormalisation group method.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) FOKUS Physics (2006)

Module title	Abbreviation
Relativistic Effects in Mesoscopic Systems	11-RMS-092-m01

Module coordinator	Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics	Faculty of Physics and Astronomy

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	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.

Contents

Relativistic effects in mesoscopic systems. - Spin-orbit coupling. - Dirac equation. - Quantum Hall effect. - Topological insulators. - Majorana fermions

Intended learning outcomes

The students have mastered the mathematical methods for the description of relativistic quantum systems, especially in the field of mesoscopic physics. They are able to apply their knowledge to simple systems.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Statistics, Data Analysis and Computer Physics			11-SDC-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Statistics, data analysis and computer physics.

Intended learning outcomes

The students have specific and advanced knowledge in the field of statistics, data analysis and Computational Physics.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Module Type 4E Special Training Experimental Physics			11-SF-4E-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas in the field of Experimental Physics.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in the field of Experimental Physics.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 8 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Module Type 4I Special Training Interdisciplinary Research Fields			11-SF-4I-072-m01
Module coordinator		**Module offered by**	
Managing Directors of the Institute of Applied Physics and the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in an interdisciplinary field.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 8 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Module Type 4N Special Training Nanostructure Technology			11-SF-4N-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas in the field of nanostructure technology.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in the field of nanostructure technology.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 8 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Module Type 4T Special Training Theoretical Physics			11-SF-4T-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas in the field of Theoretical Physics.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in the field of Theoretical Physics.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 8 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Module Type 5E Special Training Experimental Physics			11-SF-5E-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas in the field of Experimental Physics.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in the field of Experimental Physics.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Module Type 5l Special Training Interdisciplinary Research Fields			11-SF-5l-072-m01
Module coordinator		**Module offered by**	
Managing Directors of the Institute of Applied Physics and the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in an interdisciplinary field.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Module Type 5N Special Training Nanostructure Technology			11-SF-5N-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas in the field of Nanostructure Technology.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in the field of nanostructure technology.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Module Type 5T Special Training Theoretical Physics			11-SF-5T-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas in the field of Theoretical Physics.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in the field of Theoretical Physics.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Module Type 6E Special Training Experimental Physics			11-SF-6E-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas in the field of Experimental Physics.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in the field of Experimental Physics.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 12 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Module Type 6I Special Training Interdisciplinary Research Fields			11-SF-6I-072-m01
Module coordinator		**Module offered by**	
Managing Directors of the Institute of Applied Physics and the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in an interdisciplinary field.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 12 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Module Type 6N Special Training Nanostructure Technology			11-SF-6N-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas in the field of nanostructure technology.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in the field of nanostructure technology.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 12 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Module Type 6T Special Training Theoretical Physics			11-SF-6T-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas in the field of Theoretical Physics.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in the field of Theoretical Physics.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 12 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Module Type 8E Special Training Experimental Physics			11-SF-8E-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas in the field of Experimental Physics.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in the field of Experimental Physics.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 16 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Module Type 8I Special Training Interdisciplinary Research Fields			11-SF-8I-072-m01
Module coordinator		**Module offered by**	
Managing Directors of the Institute of Applied Physics and the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in an interdisciplinary field.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 16 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Module Type 8N Special Training Nanostructure Technology			11-SF-8N-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Specific, advanced knowledge of one or more of the Faculty's current research areas in the field of nanostructure technology.

Intended learning outcomes

The students have specific and advanced knowledge of one or more current research areas of the faculty in the field of nanostructure technology.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 16 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Spintronics			11-SPI-102-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

This lecture covers the basic principles of spin transport, with a particular emphasis on the phenomena of giant magnetoresistance and tunnel magnetoresistance. As a last point, we discuss new phenomena from the field of spin dynamics and current-induced spin phenomena.

Intended learning outcomes

The students know the basic principles of spin transport models and the applications of spin transport in information technology. They have gained an overview of current findings in this field (giant magnetoresistance, tunnel magnetoresistance).

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Thermodynamics and Economics			11-TDO-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Energy and economic growth, entropy production, emission reduction. Part I describes the role of energy conversion in the development of the universe, the evolution of life and the unfolding of civilisation. In non-equilibrium thermodynamics, the entropy production density shows the relevance of the second law of thermodynamics for ecological damage and resource consumption. Energy conversion, entropy production and natural resources define the technological and ecological boundaries of industrial economic growth. Part 2 analyses how the factors capital, work, energy and creativity produce the goods and services of a national economy and determine economic growth. The productive power of cheap energy by far exceeds that of expensive labour. Within the current system of taxes and social security contributions, this discrepancy between power and costs of production factors leads to job cuts, waste of resources, impoverishment of nations and growing social tensions. The course discusses how factor income taxation can counteract this development. Part 3 includes seminar presentations, comprises the techniques of rational energy use and non-fossil energy use, and introduces the optimisation programme deeco (Dynamic Energy, Emission and Cost Optimization).

Intended learning outcomes

The students understand that energy conversion and entropy production are going to play an important role in the world's economic and social development. As an extension of economic theory, the students know the connections between thermodynamics and economy as well as the productive physical basis of modern economies. They are able to apply the acquired knowledge to particular problems.
NOTE: this is the module that was run by Prof. Dr. R. Kümmel, who has now retired. As the module was tailored to his own theory of economy, it has yet to be decided whether we will continue to offer this module.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places
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Additional information
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Workload
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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Thermodynamics and Economics			11-TDOE-141-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Energy and economic growth, entropy production, emission reduction.
Part I describes the role of energy conversion in the development of the universe, the evolution of life and the unfolding of civilisation. The entropy production density of non-equilibrium thermodynamics shows the relevance of the second law of thermodynamics for ecological damage and resource consumption. Energy conversion, entropy production and natural resources define the technological and ecological boundaries of industrial economic growth.
Part 2 analyses how the factors capital, work, energy and creativity produce the goods and services of a national economy and determine economic growth. The productive power of cheap energy by far exceeds that of expensive labour. Within the current system of taxes and social security contributions, this discrepancy between power and costs of production factors leads to job cuts, waste of resources, impoverishment of nations and growing social tensions. The course discusses how factor income taxation can counteract this development.
Part 3 includes seminar presentations, comprises the techniques of rational energy use and non-fossil energy use, and introduces the optimisation programme deeco (Dynamic Energy, Emission and Cost Optimization).

Intended learning outcomes

The students understand that energy conversion and entropy production are going to play an important role in the world's economic and social development. As an extension of economic theory, the students know the connections between thermodynamics and economy as well as the productive physical basis of modern economies. They are able to apply the acquired knowledge to particular problems.
NOTE: this is the module that was run by Prof. Dr. R. Kümmel, who has now retired. As the module was tailored to his own theory of economy, it has yet to be decided whether we will continue to offer this module.

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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Theoretical Solid State Physics			11-TFK-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Principles of Theoretical Solid-State Physics. Fermi liquid theory. Electron-electron interaction. Variational methods. Magnetism. Superconductivity.

Intended learning outcomes

The students have basic knowledge of the theoretical description of solid-state phenomena. They know the corresponding mathematical or theoretical methods and are able to apply them to basic problems of solid-state theory and to understand the connections to experimental results. The individual students have elaborated on an advanced topic of solid-state theory and have discussed this topic in a seminar presentation.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Theoretical Solid State Physics 2			11-TFK2-111-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

a) metal-insulators and topological insulators
b) transport phenomena
c) magnetic impurities in metals. Kondo effect and heavy fermions
d) electron-phonon interaction
e) one-dimensional conductors

Intended learning outcomes

The students have advanced knowledge of the theoretical description of solid-state phenomena. They know the mathematical or theoretical methods and are able to apply them to problems of solid-state theory and understand the connections to experimental results. The individual students have elaborated on an advanced topic of solid-state theory and have discussed this topic in a seminar presentation.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Topology in Solid State Physics			11-TFP-132-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

The students are familiar with the theory of topological effects in Solid-State Physics. They know the mathematical methods necessary for their description and are able to apply these methods to simple problems.

Intended learning outcomes

The students are familiar with the theory of topological effects in Solid-State Physics. They know the mathematical methods necessary for their description and are able to apply these methods to simple problems.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module title			Abbreviation
Theory of Superconduction			11-TSL-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Introduction to the phenomenom of superconductivity. Microscopic theory of superconductivity (BCS theory). Phenomenological theory of superconductivity (Ginzburg-Landau theory). Mesoscopic aspects of superconductivity (Andreev scattering, Bobolioubov-de Gennes equation, SQUIDS). Quantum computing with superconductive elements.

Intended learning outcomes

The students have basic knowledge of the theoretical models for the description of superconductivity. They know the properties and application areas of these models and are able to apply calculation methods to simple problems.

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

R + 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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module title			Abbreviation
Principles of two- and threedimensional Röntgen imaging			11-ZDR-111-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	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.	

Contents

Physics of X-ray generation (X-ray tubes, synchrotron). Physics of the interaction between X-rays and matter (photon absorption, scattering), physics of X-ray detection. Mathematics of reconstruction algorithms (filtered rear projection, Fourier reconstruction, iterative methods). Image processing (image data pre-processing, feature extraction, visualisation,...). Applications of X-ray imaging in the industrial sector (component testing, material characterisation, metrology, biology, ...). Radiation protection and biological radiation effect (dose, ...).

Intended learning outcomes

The students know the principles of generating X-rays and of their interactions with matter. They know imaging techniques using X-rays and methods of image processing as well as application areas of these methods.

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

V + R (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)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Functional Materials (2012)
Master's degree (1 major) FOKUS Physics (2006)

Module title			Abbreviation
Basic module: Competence for Acquiring Information - for students of natural sciences			41-IK-NW1-072-m01
Module coordinator		**Module offered by**	
head of University Library		University Library	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
1	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Information literacy in an academic context:
- Search strategies and tools.
- Using the library's electronic resources.
- Resources for natural sciences: databases and journals.
- Online searches and search engines.
- Overview of additional resources (eLearning etc.).
- Reference management. Some sections of the module will focus on particular disciplines (wherever possible, on disciplines in the natural sciences).

Intended learning outcomes

Students know what information is needed for what purpose. They are able to locate information that is relevant within their discipline and beyond in a variety of resources and to evaluate this information. They recognise the difference in quality between information they have retrieved from specific, restricted access resources (databases) and information they have found on the free web. Students are able to manage and process the information they have found, using reference management software and eLearning tools. The module aims to equip students with the skills needed to find information and literature that is relevant to the topics of their Bachelor's theses.

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

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 (60 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2007)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Information Literacy for Students of the Natural Sciences (Basic Level)			41-IK-NW1-101-m01
Module coordinator		**Module offered by**	
head of University Library		University Library	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
2	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Information literacy in an academic context:
- Search strategies and tools.
- Using the library's electronic resources.
- Resources for natural sciences: databases and journals.
- Online searches and search engines.
- Overview of additional resources (eLearning etc.).
- Reference management. Some sections of the module will focus on particular disciplines (wherever possible, on disciplines in the natural sciences).

Intended learning outcomes

Students know what information is needed for what purpose. They are able to locate information that is relevant within their discipline and beyond in a variety of resources and to evaluate this information. They recognise the difference in quality between information they have retrieved from specific, restricted access resources (databases) and information they have found on the free web. Students are able to manage and process the information they have found, using reference management software and eLearning tools. The module aims to equip students with the skills needed to find information and literature that is relevant to the topics of their Bachelor's theses.

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

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)

a) written examination (approx. 60 minutes) or b) preparing and delivering a presentation with slides (approx. 10 minutes or approx. 5 minutes and approx. 1 page) or c) completing exercises (approx. 10 exercises) or d) presentation without slides (approx. 20 to 30 minutes) or e) preparing and delivering a presentation with slides (approx. 5 minutes) and completing exercises (approx. 5 exercises) or f) presentation without slides (approx. 10 to 15 minutes) and completing exercises (approx. 5 exercises)

Allocation of places

Number of places: 5-50. There is a restricted number of places. If necessary, places will be allocated as follows: Students of the degree programmes of the respective subject-specific focuses will be given preferential consideration. The remaining places, if and when any become available, will be allocated to students of the other natural sciences degree programmes. In each of the above-mentioned groups, 30% of places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. The remaining 70% of places will each be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in
Bachelor' degree (1 major) Biochemistry (2011)
Bachelor' degree (1 major) Biochemistry (2013)
Bachelor' degree (1 major) Biochemistry (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
No final examination Special study offering (2010)

Module title			Abbreviation
Second module: Competence for Acquiring Information - for students of natural sciences			41-IK-NW2-072-m01
Module coordinator		**Module offered by**	
head of University Library		University Library	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
2	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Information literacy in an academic context:
- More in-depth discussion of selected topics that were covered in the level one module, e. g. searching subject-specific databases.
- Publishing and information practices in the natural sciences.
- Subject-specific information retrieval tools, e. g. classifications and thesauri.
- New web-based information and communication technologies.
- Searching for subject-specific facts (e. g. substances and physical data).
- Information search skills for the workplace.
- Copyright and citations.
- Electronic publishing. Some sessions will focus on particular disciplines (wherever possible, on disciplines in the natural sciences).

Intended learning outcomes

Students have developed a differentiated understanding of the publishing and information practices in their discipline and are familiar with the possibilities offered by electronic publishing. They are able to use electronic tools to locate subject-specific facts in a variety of resources. Students are able to work with subject-specific information retrieval tools as well as to use new web-based technologies to share information. They have developed an understanding of the legal framework surrounding publications, information, and communication in an academic context and are able to use information responsibly.

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

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 (60 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2007)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006)

Module title			Abbreviation
Information Literacy for Students of the Natural Sciences (Advanced Level)			41-IK-NW2-101-m01
Module coordinator		**Module offered by**	
head of University Library		University Library	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
2	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Knowledge and skills equivalent to those achieved in the basic module desirable.	

Contents

Information literacy in an academic context:
- More in-depth discussion of selected topics that were covered in the level one module, e. g. searching subject-specific databases.
- Publishing and information practices in the natural sciences.
- Subject-specific information retrieval tools, e. g. classifications and thesauri.
- New web-based information and communication technologies.
- Searching for subject-specific facts (e. g. substances and physical data).
- Information search skills for the workplace.
- Copyright and citations.
- Electronic publishing. Some sessions will focus on particular disciplines (wherever possible, on disciplines in the natural sciences).

Intended learning outcomes

Students have developed a differentiated understanding of the publishing and information practices in their discipline and are familiar with the possibilities offered by electronic publishing. They are able to use electronic tools to locate subject-specific facts in a variety of resources. Students are able to work with subject-specific information retrieval tools as well as to use new web-based technologies to share information. They have developed an understanding of the legal framework surrounding publications, information, and communication in an academic context and are able to use information responsibly.

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

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)

a) written examination (approx. 60 minutes) or b) preparing and delivering a presentation with slides (approx. 10 minutes or approx. 5 minutes and approx. 1 page) or c) completing exercises (approx. 10 exercises) or d) presentation without slides (approx. 20 to 30 minutes) or e) preparing and delivering a presentation with slides (approx. 5 minutes) and completing exercises (approx. 5 exercises) or f) presentation without slides (approx. 10 to 15 minutes) and completing exercises (approx. 5 exercises)

Allocation of places

Number of places: 10 to 50. There is a restricted number of places. If necessary, places will be allocated as follows: Students of the degree programmes of the respective subject-specific focuses will be given preferential consideration. The remaining places, if and when any become available, will be allocated to students of the other natural sciences degree programmes. In each of the above-mentioned groups, 30% of places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. The remaining 70% of places will each be allocated by lot.

Additional information

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Workload

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Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Bachelor' degree (1 major) Biochemistry (2011) Bachelor' degree (1 major) Biochemistry (2013) Bachelor' degree (1 major) Biochemistry (2009) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Module title			Abbreviation
Intercultural Competence (English, Advanced Level)			42-ENO-IK-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	numerical grade	42-ENM2 or 42-ENM3 or 42-ENM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with knowledge and skills that will enable them to act and communicate in intercultural situations. It familiarises them with criteria and options for action and equips them with knowledge that will allow them to adequately interpret intercultural situations and act appropriately.

Intended learning outcomes

Students develop advanced intercultural and language skills that will allow them to communicate, both verbally and in writing, in a globalised world, taking intercultural aspects into account. They are able to effectively and flexibly use the target language, both during study abroad periods and in the workplace. This module builds on level "B2 -- Vantage" and aims to enable students to reach level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: English

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)
No final examination Special study offering (2010)

Module title			Abbreviation
Cultural Studies (English, Advanced Level)			42-ENO-LK-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	numerical grade	42-ENM2 or 42-ENM3 or 42-ENM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module familiarises students with the culture and society of countries where the target language is spoken and thus enables them to act appropriately in the target language. It discusses the culture, geography, history, society, political system, and the economy of said countries.

Intended learning outcomes

Students develop highly advanced language skills and a thorough familiarity with the culture and society of countries where the target language is spoken. They are thus able to communicate, both verbally and in writing, in a variety of situations, taking into account aspects related to the culture and society of said countries. Students are able to effectively and flexibly use the target language, both during study abroad periods and in the workplace. This module builds on level "B2 -- Vantage" and aims to enable students to reach level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: English

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)

Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)
No final examination Special study offering (2010)

Module title			Abbreviation
English for the Natural Sciences 1 (Advanced Level)			42-ENO-NW1-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	42-ENM2 or 42-ENM3 or 42-ENM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with advanced communication skills in the target language. These will allow them to communicate appropriately, in both written and oral form, in science-oriented situations.

Intended learning outcomes

Students gain sound natural sciences-specific communication skills (written and oral) in the target language. They develop advanced natural sciences-specific language skills that will allow them to communicate about selected topics in corresponding situations, using language flexibly. Students are proficient in scientific terminology and are able to communicate effectively within the discipline. At the end of the stage, they will have developed natural sciences-specific language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

Ü + 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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: English
Assessment offered: once a year, winter semester

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
No final examination Special study offering (2010)

Module title			Abbreviation
English for the Natural Sciences 2 (Advanced Level)			42-ENO-NW2-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	42-ENM2 or 42-ENM3 or 42-ENM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with advanced communication skills in the target language. These will allow them to communicate appropriately, in both written and oral form, in science-oriented situations.

Intended learning outcomes

Students gain sound natural sciences-specific communication skills (written and oral) in the target language. They develop advanced natural sciences-specific language skills that will allow them to communicate about selected topics in corresponding situations, using language flexibly. Students are proficient in scientific terminology and are able to communicate effectively within the discipline. At the end of the stage, they will have developed natural sciences-specific language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

Ü + 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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: English
Assessment offered: once a year, summer semester

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)

No final examination Special study offering (2010)

Module title			Abbreviation
Advanced English Final Exam			42-ENO-PR-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
2	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Registration for assessment: as specified.	

Contents

Final exam in the upper level of the target language.

Intended learning outcomes

In this exam, students will be expected to demonstrate language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages. Students who passed the exam may obtain a UNIcert(R) Level III certificate once the university has been accredited.

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

no courses assigned

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 and oral examination (200 to 210 minutes total) testing the candidate's skills in the following four areas: reading and listening comprehension, writing and oral communication skills; only if all components have been successfully completed will assessment be considered successfully completed
Language of assessment: English
Assessment offered: once a year (autumn, semester break)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)

Module title			Abbreviation
French for the Humanities 1 (Advanced Level)			42-FRO-GW1-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	42-FRM2 or 42-FRM3 or 42-FRM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with advanced communication skills in the target language. These will allow them to communicate appropriately, in both written and oral form, at university and in business settings.

Intended learning outcomes

Students gain sound humanities-specific communication skills (written and oral) in the target language. They develop advanced humanities-specific language skills that will allow them to communicate about selected topics in corresponding situations, using language flexibly. Students are proficient in humanities terminology and are able to communicate effectively within the discipline. At the end of the stage, they will have developed humanities-specific language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: French
Assessment offered: once a year, winter semester

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)

No final examination Special study offering (2010)

Module title			Abbreviation
French for the Humanities 2 (Advanced Level)			42-FRO-GW2-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	42-FRM2 or 42-FRM3 or 42-FRM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with advanced communication skills in the target language. These will allow them to communicate appropriately, in both written and oral form, at university and in business settings.

Intended learning outcomes

Students gain sound humanities-specific communication skills (written and oral) in the target language. They develop advanced humanities-specific language skills that will allow them to communicate about selected topics in corresponding situations, using language flexibly. Students are proficient in humanities terminology and are able to communicate effectively within the discipline. At the end of the stage, they will have developed humanities-specific language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: French
Assessment offered: once a year, summer semester

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)

No final examination Special study offering (2010)

Module title			Abbreviation
Intercultural Competence (French, Advanced Level)			42-FRO-IK-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	numerical grade	42-FRM2 or 42-FRM3 or 42-FRM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with knowledge and skills that will enable them to act and communicate in intercultural situations. It familiarises them with criteria and options for action and equips them with knowledge that will allow them to adequately interpret intercultural situations and act appropriately.

Intended learning outcomes

Students develop advanced intercultural and language skills that will allow them to communicate, both verbally and in writing, in a globalised world, taking intercultural aspects into account. They are able to effectively and flexibly use the target language, both during study abroad periods and in the workplace. This module builds on level "B2 -- Vantage" and aims to enable students to reach level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: French

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)
No final examination Special study offering (2010)

Module title			Abbreviation
Intercultural Competence (French, Advanced Level)			42-FRO-LK-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	numerical grade	42-FRM2 or 42-FRM3 or 42-FRM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module familiarises students with the culture and society of countries where the target language is spoken and thus enables them to act appropriately in the target language. It discusses the culture, geography, history, society, political system, and the economy of said countries.

Intended learning outcomes

Students develop highly advanced language skills and a thorough familiarity with the culture and society of countries where the target language is spoken. They are thus able to communicate, both verbally and in writing, in a variety of situations, taking into account aspects related to the culture and society of said countries. Students are able to effectively and flexibly use the target language, both during study abroad periods and in the workplace. This module builds on level "B2 -- Vantage" and aims to enable students to reach level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: French

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)
No final examination Special study offering (2010)

Module title			Abbreviation
Advanced French Final Exam			42-FRO-PR-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
2	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Registration for assessment: as specified.	

Contents

Final exam in the upper level of the target language.

Intended learning outcomes

In this exam, students will be expected to demonstrate language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages. Students who passed the exam may obtain a UNIcert(R) Level III certificate once the university has been accredited.

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

no courses assigned

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 and oral examination (200 to 210 minutes total) testing the candidate's skills in the following four areas: reading and listening comprehension, writing and oral communication skills; only if all components have been successfully completed will assessment be considered successfully completed
Language of assessment: French
Assessment offered: once a year (autumn, semester break)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)

Module title			Abbreviation
French for Business 1 (Advanced Level)			42-FRO-W1-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	42-FRM2 or 42-FRM3 or 42-FRM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with advanced communication skills in the target language. These will allow them to communicate appropriately, in both written and oral form, at university and in business settings.

Intended learning outcomes

Students gain sound business- and economics-specific communication skills (written and oral) in the target language. They develop advanced business- and economics-specific language skills that will allow them to communicate about selected topics in corresponding situations, using language flexibly. Students are proficient in business and economics terminology and are able to communicate effectively within the discipline. At the end of the stage, they will have developed business- and economics-specific language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: French
Assessment offered: once a year, winter semester

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
No final examination Special study offering (2010)

Module title			Abbreviation
French for Business 2 (Advanced Level)			42-FRO-W2-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	42-FRM2 or 42-FRM3 or 42-FRM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with advanced communication skills in the target language. These will allow them to communicate appropriately, in both written and oral form, at university and in business settings.

Intended learning outcomes

Students gain sound business- and economics-specific communication skills (written and oral) in the target language. They develop advanced business- and economics-specific language skills that will allow them to communicate about selected topics in corresponding situations, using language flexibly. Students are proficient in business and economics terminology and are able to communicate effectively within the discipline. At the end of the stage, they will have developed business- and economics-specific language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: French
Assessment offered: once a year, summer semester

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
No final examination Special study offering (2010)

Module title			Abbreviation
Spanish for the Humanities 1 (Advanced Level)			42-SPO-GW1-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with advanced communication skills in the target language. These will allow them to communicate appropriately, in both written and oral form, in situations involving humanistic topics.

Intended learning outcomes

Students gain sound humanities-specific communication skills (written and oral) in the target language. They develop advanced humanities-specific language skills that will allow them to communicate about selected topics in corresponding situations, using language flexibly. Students are proficient in humanities terminology and are able to communicate effectively within the discipline. At the end of the stage, they will have developed humanities-specific language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: Spanish
Assessment offered: once a year, winter semester

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)

No final examination Special study offering (2010)

Module title			Abbreviation
Spanish for the Humanities 2 (Advanced Level)			42-SPO-GW2-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with advanced communication skills in the target language. These will allow them to communicate appropriately, in both written and oral form, in situations involving humanistic topics.

Intended learning outcomes

Students gain sound humanities-specific communication skills (written and oral) in the target language. They develop advanced humanities-specific language skills that will allow them to communicate about selected topics in corresponding situations, using language flexibly. Students are proficient in humanities terminology and are able to communicate effectively within the discipline. At the end of the stage, they will have developed humanities-specific language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: Spanish
Assessment offered: once a year, summer semester

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)

No final examination Special study offering (2010)

Module title			Abbreviation
Intercultural Competence (Spanish, Advanced Level)			42-SPO-IK-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	numerical grade	42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with knowledge and skills that will enable them to act and communicate in intercultural situations. It familiarises them with criteria and options for action and equips them with knowledge that will allow them to adequately interpret intercultural situations and act appropriately.

Intended learning outcomes

Students develop advanced intercultural and language skills that will allow them to communicate, both verbally and in writing, in a globalised world, taking intercultural aspects into account. They are able to effectively and flexibly use the target language, both during study abroad periods and in the workplace. This module builds on level "B2 -- Vantage" and aims to enable students to reach level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: Spanish

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)
No final examination Special study offering (2010)

Module title			Abbreviation
Cultural Studies (Spanish, Advanced Level)			42-SPO-LK-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	numerical grade	42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module familiarises students with the culture and society of countries where the target language is spoken and thus enables them to act appropriately in the target language. It discusses the culture, geography, history, society, political system, and the economy of said countries.

Intended learning outcomes

Students develop highly advanced language skills and a thorough familiarity with the culture and society of countries where the target language is spoken. They are thus able to communicate, both verbally and in writing, in a variety of situations, taking into account aspects related to the culture and society of said countries. Students are able to effectively and flexibly use the target language, both during study abroad periods and in the workplace. This module builds on level "B2 -- Vantage" and aims to enable students to reach level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: Spanish

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)
No final examination Special study offering (2010)

Module title			Abbreviation
Advanced Spanish Final Exam			42-SPO-PR-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
2	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Registration for assessment: as specified.	

Contents

Final exam in the upper level of the target language.

Intended learning outcomes

In this exam, students will be expected to demonstrate language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages. Students who passed the exam may obtain a UNIcert(R) Level III certificate once the university has been accredited.

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

no courses assigned

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 and oral examination (200 to 210 minutes total) testing the candidate's skills in the following four areas: reading and listening comprehension, writing and oral communication skills; only if all components have been successfully completed will assessment be considered successfully completed
Language of assessment: Spanish
Assessment offered: once a year (autumn, semester break)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
Magister Theologiae Catholic Theology (2009)

Module title			Abbreviation
Spanish for Business 1 (Advanced Level)			42-SPO-W1-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module equips students with advanced communication skills in the target language. These will allow them to communicate appropriately, in both written and oral form, at university and in business settings.

Intended learning outcomes

Students gain sound business- and economics-specific communication skills (written and oral) in the target language. They develop advanced business- and economics-specific language skills that will allow them to communicate about selected topics in corresponding situations, using language flexibly. Students are proficient in business and economics terminology and are able to communicate effectively within the discipline. At the end of the stage, they will have developed business- and economics-specific language skills that are equivalent to level "C1 -- Effective Operational Proficiency" of the Common European Framework of Reference for Languages.

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: Spanish
Assessment offered: once a year, winter semester

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
Master's degree (1 major) Nanostructure Technology (2011)

Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
No final examination Special study offering (2010)

Module title			Abbreviation
Spanish for Business 2 (Advanced Level)			42-SPO-W2-072-m01
Module coordinator		**Module offered by**	
head of Language Centre (ZFS)		Language Centre (ZfS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	numerical grade	42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

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

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)

option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills) or option 2: oral assessment (approx. 10 minutes) and written multi-component examination (approx. 60 to 90 minutes total) with 3 components (reading comprehension, listening comprehension, writing) or option 3: 2 to 4 oral assessments (approx. 30 to 60 minutes total) as well as 2 to 4 written assessments (approx. 10 to 15 pages total), all components/assessments each weighted 1:1; options will be selected and examination dates be fixed at the beginning of the course
Language of assessment: Spanish
Assessment offered: once a year, summer semester

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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

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Module appears in

Bachelor' degree (1 major) Chemistry (2009)
Bachelor' degree (1 major) Business Management and Economics (2009)
Bachelor' degree (1 major) Business Management and Economics (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Business Information Systems (2009)
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Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Bachelor's degree (1 major, 1 minor) Pedagogy (2009)
No final examination Special study offering (2010)