Module Catalogue
for the Subject

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

Examination regulations version: 2007
Responsible: Faculty of Physics and Astronomy
Contents

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

15-Apr-2008 (2008-7)

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.
Compulsory Courses
(132 ECTS credits)
Nanostructure Technology
(12 ECTS credits)
<table>
<thead>
<tr>
<th><strong>Module title</strong></th>
<th><strong>Abbreviation</strong></th>
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<tbody>
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<td>Basics of Nanostructure Technology</td>
<td>11-N1-072-m01</td>
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<tr>
<th><strong>Module coordinator</strong></th>
<th><strong>Module offered by</strong></th>
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<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
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<th><strong>Module level</strong></th>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Principles of producing, characterising and applying nanostructures.

**Intended learning outcomes**

The students have knowledge of the fundamental properties, technologies, characterising methods and functions of nanostructures.

**Courses**

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

**Method of assessment**

written examination (approx. 90 minutes)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

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### 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

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

### Method of assessment

written examination (approx. 90 minutes)

### Allocation of places

--

### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)
Lab Course Engineering

(18 ECTS credits)
### Module Catalogue for the Subject
**Nanostructure Technology**
Bachelor's with 1 major, 180 ECTS credits

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<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>11-A3</td>
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### Contents
Principles of Nuclear, Atomic and Molecular Physics, experiments on cryogenic temperatures and correlated systems, properties of solids, surfaces and interfaces.

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

### Courses
(type, number of weekly contact hours, language — if other than German)
- Fortgeschrittenen-Praktikum Bachelor Theorie (Advanced Practical Course Bachelor Theory): S (1 weekly contact hour)
- Fortgeschrittenen-Praktikum Bachelor Praxis (Advanced Practical Course Bachelor Practice): P (3 weekly contact hours)

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

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

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

### Allocation of places

### Additional information

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

Advanced Undergraduate Laboratory (Classical Mechanics, Thermodynamics, Basic Circuitry)

Abbreviation

11-PGA-NN-072-m01

Module coordinator

Managing Director of the Institute of Applied Physics

Module offered by

Faculty of Physics and Astronomy

ECTS

4

Method of grading

Only after succ. compl. of module(s)

(not) successfully completed

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Duration

1 semester

Module level

undergraduate

Other prerequisites

Recommended: 11-PFR

Contents

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

Intended learning outcomes

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

Courses

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

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

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

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

Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

This module has the following assessment components

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

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

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

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

Allocation of places

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Additional information

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

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## Module title

### Advanced Undergraduate Laboratory (Optics, Basic Semiconductor Circuits)

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### Module coordinator

Managing Director of the Institute of Applied Physics

### Module offered by

Faculty of Physics and Astronomy

### ECTS

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### Duration

1 semester

### Module level

undergraduate

### Other prerequisites

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### Contents

Physical laws of atomic physics, nuclear physics and wave optics. Basic measuring methods using computers and storage oscilloscopes.

### Intended learning outcomes

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

### Courses

- Wellenoptik (Physical Optics, WOP): P (2 weekly contact hours)
- Atom- und Kernphysik (Atomic and Nuclear Physics, AKP): P (2 weekly contact hours)
- Computer und Messtechnik (Computers and Measurement Technology, CMT): P (2 weekly contact hours)

### Method of assessment

This module has the following assessment components

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

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

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

To pass this module, students must pass the assessment components.

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)
Module title | Abbreviation
---|---
Industrial Internship | 11-PFI-072-m01

Module coordinator | Module offered by
Managing Director of the Institute of Applied Physics | Faculty of Physics and Astronomy

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

Duration | Module level | Other prerequisites
---|---|---
1 semester | undergraduate | --

Contents
Insights into industrial methods, work processes, goals and production methods. Summary of own experiences and tasks in a report and an oral presentation.

Intended learning outcomes
The students have knowledge and practical experience of using a variety of industrial technologies with relevance to nanostructure technology and are able to summarise their experience in a report and an oral presentation.

Courses (type, number of weekly contact hours, language — if other than German)
P + 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 is creditable for bonus)
placement report / fieldwork report / report on practical training / report on practical course / project report / report on technical course (20 pages)

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Mathematics for Engineers
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<th>Other prerequisites</th>
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<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>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.</td>
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</table>

**Contents**

Ordinary and partial differential equations in Physics.

**Intended learning outcomes**

The students have basic mathematical knowledge of dynamic equations and solution methods for common and 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 is creditable for bonus)

written examination (approx. 120 minutes)

**Allocation of places**

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**Additional information**

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

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<td>Mathematics 1 for students in Nanostructural Engineering</td>
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<td>Dean of Studies Mathematik (Mathematics)</td>
<td>Institute of Mathematics</td>
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<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**
Basics on numbers and functions, sequences and series, differential and integral calculus in one variable, vector spaces, simple differential equations.

**Intended learning outcomes**
The student gets acquainted with basic concepts of mathematics. He/She learns to apply these methods to simple problems in natural and engineering sciences, in particular in the field of nanostructure technology, and is able to interpret the results.

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

**Method of assessment**
written examination (90 minutes)

**Allocation of places**
--

**Additional information**
--

**Referred to in LPO I**
(examination regulations for teaching-degree programmes)
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### Module Catalogue for the Subject
Nanostructure Technology

**Bachelor's with 1 major, 180 ECTS credits**

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<td>Mathematics 2 for students in Nanostructural Engineering</td>
<td>10-M-NST2-072-m01</td>
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**Module coordinator**

Dean of Studies Mathematik (Mathematics)

**Module offered by**

Institute of Mathematics

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</table>

**Duration**

1 semester

**Module level**

undergraduate

**Other prerequisites**

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### Contents

Linear maps and systems of linear equations, matrix calculus, eigenvalue theory, differential and integral calculus in several variables, differential equations, Fourier analysis.

### Intended learning outcomes

The student gets acquainted with fundamental concepts of advanced mathematics. He/She learns to apply these methods to simple problems in natural and engineering sciences, in particular in the field of nanostructure technology, and is able to interpret the results.

### Courses

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

### Method of assessment

written examination (90 minutes)

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Chemistry
(10 ECTS credits)
Module title | Abbreviation
---|---
General Chemistry for Physics and Engineers | 08-CP1-072-m01

Module coordinator | Module offered by
lecturer of the course | Institute of Inorganic Chemistry

<table>
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<tr>
<th>ECTS</th>
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<td>1 semester</td>
<td>undergraduate</td>
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Contents

German contents available but not translated yet.

Das Modul vermittelt die Grundlagen der Anorganischen sowie der Organischen Chemie. Im Praktikum lernen die Studierenden zudem grundlegende Arbeitstechniken kennen und führen einfache Versuche selbst durch.

Intended learning outcomes

German intended learning outcomes available but not translated yet.


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

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

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

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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 08-IOC-1-072: Organic Chemistry for students of medicine, biomedicine, dental medicine, engineering and natural science

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

Assessment in module component 08-CP1-1-072: Basics of General and Inorganic Chemistry

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

Assessment in module component 08-CP1-3-072: General and Analytical Chemistry (lab)

- 2 ECTS, Method of grading: (not) successfully completed
- for each experiment: Vortestate (pre-experiment exams, approx. 10 minutes each), assessment of practical performance (log, 2 to 5 pages), Nachtestate (post-experiment exams, approx. 10 minutes each)
- Assessment offered: once a year, summer semester
- Only after successful completion of module components: Successful completion of module component 08-CP1-1 is a prerequisite for participation in module component 08-CP1-3.

Allocation of places

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<table>
<thead>
<tr>
<th>Additional information</th>
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</thead>
<tbody>
<tr>
<td>Referred to in LPO I (examination regulations for teaching-degree programmes)</td>
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Experimental Physics

(42 ECTS credits)
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<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Experimental Physics 1 (Mechanics, Thermodynamics, Waves and Oscillations)</td>
<td>11-É1-072-m01</td>
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<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
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<td>Faculty of Physics and Astronomy</td>
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</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

### Contents
Physical laws of mechanics, vibrations and waves, thermodynamics

### Intended learning outcomes
The students understand the basic contexts and principles of mechanics, vibration, waves and thermodynamics.

### 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 is creditable for bonus)
written examination (approx. 120 minutes)

### Allocation of places
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### Additional information
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### Referred to in LPO I (examination regulations for teaching-degree programmes)
--
### Module title
Experimental Physics 2 (Electrics and Magnetism)

### Abbreviation
11-E2-072-m01

### Module coordinator
Managing Director of the Institute of Applied Physics

### Module offered by
Faculty of Physics and Astronomy

### ECTS
8

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
--

### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
--

### Contents
Physical laws of the science of electricity, magnetism, electromagnetic vibrations and waves

### Intended learning outcomes
The students understand the basic contexts and principles of science of electricity, magnetism, electromagnetic vibrations and waves.

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

### Method of assessment
written examination (approx. 120 minutes)

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

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<table>
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<th>Abbreviation</th>
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<tbody>
<tr>
<td>Experimental Physics 3 (Optics, Quantum Phenomena, Introduction Atomic Physics)</td>
<td>11-E3-072-m01</td>
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**Module coordinator**
Managing Director of the Institute of Applied Physics

**Module offered by**
Faculty of Physics and Astronomy

**ECTS**

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**Duration**

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**Contents**
Physical laws of optics, quantum phenomena, introduction to Atomic Physics.

**Intended learning outcomes**
The students have knowledge of the basic contexts and principles of optics, quantum phenomena and Atomic Physics.

**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 is creditable for bonus)
written examination (approx. 120 minutes)

**Allocation of places**

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**Additional information**

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<tr>
<td>Experimental Physics 4 (Introduction to Solid State Physics)</td>
<td>11-E4-072-m01</td>
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**Module coordinator**
Managing Director of the Institute of Applied Physics

**Module offered by**
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    | --                      |

**Contents**
Physical laws of solids: Bonding and structure, lattice dynamics, thermal properties, principles of electronic properties (free electron gas).

**Intended learning outcomes**
The students have knowledge of the basic contexts and principles of solids: Bonding and structure, lattice dynamics, thermal properties, principles of electronic properties (free electron gas).

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

**Method of assessment**
written examination (approx. 120 minutes)

**Allocation of places**
--

**Additional information**
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<table>
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<tbody>
<tr>
<td>Experimental Physics 5 (Physics of Atoms and Molecules)</td>
<td>11-E5-072-m01</td>
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**Module coordinator**

Managing Director of the Institute of Applied Physics

**Module offered by**

Faculty of Physics and Astronomy

**ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** |
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<tr>
<td>1 semester</td>
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**Contents**

Physical laws of Atomic and Molecular Physics.

**Intended learning outcomes**

The students have knowledge of the basic contexts and principles of Atomic and Molecular Physics (atoms: Quantum mechanical atom model, one/multi-electron atoms, electronic dipole transitions, atoms in B field as well as molecules: Bonding models and elementary excitations: rotations, vibrations, electronic excitations)

**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 is creditable for bonus)

written examination (approx. 120 minutes)

**Allocation of places**

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<tr>
<td>Experimental Physics 7 (Solid State Phenomena [Semiconductor, Superconductivity, Magnetism])</td>
<td>11-E7-072-m01</td>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>Physical laws of solid-state phenomena (semiconductors, superconductivity, magnetism)</td>
</tr>
</tbody>
</table>

**Intended learning outcomes**

The students have knowledge of the basic contexts and principles of electronic transport and electrical properties (semi-conductors: Doping effects, pn transitions, metal-semiconductor interfaces; superconductivity: phenomenological models, BCS model; magnetism: Dia-, para- and ferromagnetism, mean field description of magnetic order)

**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 is creditable for bonus)

written examination (approx. 120 minutes)

**Allocation of places**

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**Additional information**

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Theoretical Physics
(16 ECTS credits)
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<th>Abbreviation</th>
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<td>Theoretical Physics 1 (Theoretical Mechanics)</td>
<td>11-T1-072-m01</td>
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**Contents**

Newtonian mechanics, Lagrangian mechanics, Hamiltonian equation of motion, conservation laws.

**Intended learning outcomes**

The students have knowledge of the principles of classical theoretical mechanics and the required calculation methods.

**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 is creditable for bonus)

written examination (approx. 120 minutes)

**Allocation of places**

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<td>Theoretical Physics 3 (Theoretical Quantum Mechanics)</td>
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**Contents**

Limits of classical physics, Schrödinger equation, mathematical foundations of quantum mechanics, harmonic oscillator, angular momentum and spin, hydrogen atom, many-particle systems.

**Intended learning outcomes**

The students have knowledge of the principles of quantum mechanics and the required calculation methods.

**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 is creditable for bonus)

written examination (approx. 120 minutes)

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<td>Theoretical Physics 3 FOKUS (Theoretical Quantum Mechanics)</td>
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**Contents**

Limits of classical physics, Schrödinger equation, mathematical foundations of quantum mechanics, harmonic oscillator, angular momentum and spin, hydrogen atom, many-particle systems

**Intended learning outcomes**

The students have knowledge of the principles of quantum mechanics and the required calculation methods

**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 is creditable for bonus)

written examination (approx. 120 minutes)

**Allocation of places**

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**Additional information**

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

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Module Comprehensive Tests
(8 ECTS credits)
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<td>Comprehensive Exam in Theoretical Physics / Nanostructure Technology</td>
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</table>

### Contents

The purpose of the examination is to determine whether the candidate understands the connections between fundamental physical and chemical terms and laws and is able to apply the acquired scientific methods.

### Intended learning outcomes

The students know the connections between fundamental physical and chemical terminology and laws and are able to apply the acquired scientific methods.

### Courses

A (no information on SWS (weekly contact hours) and course language available)

### Method of assessment

oral examination of one candidate each (approx. 30 minutes)

### Allocation of places

--

### Additional information

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### Referred to in LPO I

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<table>
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**Contents**

The purpose of the examination is to determine whether the candidate has profound methodological knowledge of engineering and is able to apply the acquired scientific methods.

**Intended learning outcomes**

The students have founded methodological knowledge in engineering and are able to apply the acquired scientific methods.

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

A (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 is creditable for bonus)

oral examination of one candidate each (approx. 30 minutes)

**Allocation of places**

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**Additional information**

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Compulsory Electives
(18 ECTS credits)
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<td>Dean of Studies Chemie and Pharmazie (Chemistry and Pharmacy)</td>
<td>Chair of Chemical Technology of Material Synthesis</td>
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### Contents

German contents available but not translated yet.


### Intended learning outcomes

German intended learning outcomes available but not translated yet.


### Courses

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

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<tr>
<td>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)</td>
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### Allocation of places

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### Additional information

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

--
### Module title
Nanoparticle Synthesis and Structuring Technologies

### Abbreviation
08-NM-NS-072-m01

### Module coordinator
Dean of Studies Chemie and Pharmazie (Chemistry and Pharmacy)

### Module offered by
Chair of Chemical Technology of Material Synthesis

### ECTS
6

### Method of grading
Numerical grade

### Only after succ. compl. of module(s)
--

### Duration
1 semester

### Module level
Undergraduate

### Other prerequisities
--

### Contents
German contents available but not translated yet.


### Intended learning outcomes
The student has advanced knowledge in at least one application area or technology focus of engineering work, with a particular focus on nanoparticle analysis and structuring technologies.

### Courses
V + R (no information on SWS (weekly contact hours) and course language available)

### Method of assessment
(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
--

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

--
**Module title**
Nanomatrix insulation systems and photovoltaics

**Abbreviation**
11-NM-WP-072-m01

**Module coordinator**
Managing Director of the Institute of Applied Physics

**Module offered by**
Faculty of Physics and Astronomy

**ECTS**
6

**Method of grading**
Only after succ. compl. of module(s)

**Numerical grade**
--

**Duration**
1 semester

**Module level**
undergraduate

**Other prerequisites**
--

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

**Method of assessment**
(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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### Module Catalogue for the Subject Nanostructure Technology
Bachelor’s with 1 major, 180 ECTS credits

<table>
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<td>Nanomatrix semiconductor materials</td>
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<tbody>
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<td>1 semester</td>
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### 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

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

### Method of assessment

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

### Allocation of places

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### Additional information

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

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<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Nanomatrix Semiconductor Processing</td>
<td>11-NM-HP-072-m01</td>
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<td>Faculty of Physics and Astronomy</td>
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**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 is creditable for 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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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<tr>
<td>Principles Micro/Nano- and Optoelectronic Devices</td>
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**Module coordinator**
Managing Director of the Institute of Applied Physics

**Module offered by**
Faculty of Physics and Astronomy

**ECTS** | **Method of grading** | **Duration** | **Module level** | **Other prerequisites** |
---|---|---|---|---|
6 | only after succ. compl. of module(s) | 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 optoelectronic 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**
V + R (no information on SWS (weekly contact hours) and course language available)

**Method of assessment**
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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<td>Nanomatrix Biomedical Materials</td>
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<tr>
<td>chairperson of examination committee of the Master's degree programme Human-Computer Interaction</td>
<td>Faculty of Medicine</td>
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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, nanostucturing 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

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 is creditable for 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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Referred to in LPO I

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<td>Nanomatrix Biocompatible Structuring Technologies</td>
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<td>Dean of Studies Biologie (Biology)</td>
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### 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

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

<table>
<thead>
<tr>
<th>Method of assessment</th>
<th>(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)</th>
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### Allocation of places

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### Additional information

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<td>Nanomatrix Biophysical Analyzing Systems and Processes</td>
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**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 nano-structuring, 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**

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

**Method of assessment**

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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**Referred to in LPO 1** (examination regulations for teaching-degree programmes)

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Thesis
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<td>Bachelor Thesis Nanostructure Technology</td>
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<td>1 semester</td>
<td>Other prerequisites</td>
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<tr>
<td>Contents</td>
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<tr>
<td>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 Bachelor's thesis.</td>
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<tr>
<td>Intended learning outcomes</td>
<td></td>
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<tr>
<td>The students are able to independently work on an experimental, theoretical and engineering task from nanostructure technology under the guidance of a supervisor, especially in accordance with known methods and scientific aspects and to summarise their results in a final paper.</td>
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<tr>
<td>Courses</td>
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<tr>
<td>no courses assigned</td>
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<td>Method of assessment</td>
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<tr>
<td>written thesis (approx. 25 pages)</td>
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<td>Allocation of places</td>
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<td>Additional information</td>
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Subject-specific Key Skills
(14 ECTS credits)
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<tr>
<td>Theoretical Physics 2 (Theoretical Electrostatics and Electrodynamics)</td>
<td>11-T2-072-m01</td>
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**Module coordinator**
Managing Director of the Institute of Theoretical Physics and Astrophysics

**Module offered by**
Faculty of Physics and Astronomy

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</table>

**Contents**
Electrostatics, magnetostatics, Maxwell equations, covariant formulation, electrodynamics and matter.

**Intended learning outcomes**
The students have knowledge of the principles of classical electrodynamics and the required calculation methods.

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

**Method of assessment**
written examination (approx. 120 minutes)

**Allocation of places**
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**Additional information**
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**Referred to in LPO I**
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<table>
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<th>Module title</th>
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<tr>
<td>Theoretical Physics 4 (Theoretical Thermodynamics and Statistics)</td>
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**Contents**

Principles of thermodynamics, fundamental theorems, thermodynamic potentials, principles of statistical mechanics.

**Intended learning outcomes**

The students have knowledge of the principles of thermodynamics and statistical mechanics and the required calculation methods.

**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 is creditable for bonus)

written examination (approx. 120 minutes)

**Allocation of places**

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**Additional information**

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<td>Mathematics 4 for Students of Physics and Engineering</td>
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### Contents

Functional analysis and complex analysis.

### Intended learning outcomes

The students have basic knowledge of mathematics of Hilbert space and the theory of functions of a complex variable as well as the required calculation methods.

### Courses

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

### Method of assessment

written examination (approx. 120 minutes)

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)
### Module title
Measurements and Data Analysis

### Abbreviation
11-PFR-072-m01

### Module coordinator
Managing Director of the Institute of Applied Physics

### Module offered by
Faculty of Physics and Astronomy

### ECTS
2

### Method of grading
Only after succ. compl. of module(s)

### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
--

### Contents
Types of error, error approximation and propagation, graphs, linear regression, average values and standard deviation, distribution functions, significance tests, writing of lab reports and publications.

### Intended learning outcomes
In this module, the students acquire subject-specific transferable skills. They have knowledge of practical experimental work, error propagation and the principles of statistics.

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

### Method of assessment
written examination (approx. 120 minutes)

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

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Module title | Abbreviation
---|---
Computational Physics | 11-A1-072-m01

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

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Contents
Introduction to two of the programming languages relevant for students of Physics and Engineering, solving physical problems with computer programmes.

Intended learning outcomes
The students have acquired the following transferable skills: Basic knowledge of two programming languages, skills in working with computers, knowledge of algorithms to solve numeric physical 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 is creditable for bonus)
written examination (approx. 120 minutes)

Allocation of places
--

Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module title | Abbreviation
---|---
Laboratory and Measurement Technology | 11-A3-072-m01

**Module coordinator**
Managing Director of the Institute of Applied Physics

**Module offered by**
Faculty of Physics and Astronomy

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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>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.</td>
</tr>
</tbody>
</table>

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

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

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

**Method of assessment**
written examination (approx. 120 minutes)

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

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