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: 2011
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:

\[ \text{ASPO2009} \]

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

- \(29\)-\text{Jun-2011 (2011-48) except for mandatory electives added in Fast Track procedure at a later time} \\
- \(2\)-\text{Sep-2014 (2014-50) except for mandatory electives added in Fast Track procedure at a later time} \\
- \(17\)-\text{Dec-2014 (2014-86)}

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

### Compulsory Courses (44 ECTS credits)

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Module title</th>
<th>ECTS credits</th>
<th>Method of grading</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-FS-N-072-m01</td>
<td>Professional Specialization Nanostructure Technology</td>
<td>15</td>
<td>NUM</td>
<td>9</td>
</tr>
<tr>
<td>11-MP-N-072-m01</td>
<td>Scientific Methods and Project Management Nanostructure Technology</td>
<td>15</td>
<td>NUM</td>
<td>10</td>
</tr>
<tr>
<td>11-PFM-111-m01</td>
<td>Advanced Practical Course Master</td>
<td>10</td>
<td>B/NB</td>
<td>90</td>
</tr>
<tr>
<td>11-OSN-111-m01</td>
<td>Advanced Seminar Nanostructure Technology</td>
<td>4</td>
<td>NUM</td>
<td>99</td>
</tr>
</tbody>
</table>

### Compulsory Electives (46 ECTS credits)

#### Specialization in Nanostructure Technology (40 ECTS credits)

Modules worth a total of 40 ECTS credits must be successfully completed. Of these 40 ECTS credits, no less than 10 must be achieved in one of the two sub-areas "Elektronik und Photonik" ("Electronics and Photonics") and "Energie- und Materialforschung" ("Energy and Materials Research"). No less than 10 ECTS credits must be achieved in the sub-area "Allgemeine Physik" ("General Physics"). The remaining 20 ECTS credits may be achieved in any of the sub areas.

#### Electronics and Photonics

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Module title</th>
<th>ECTS credits</th>
<th>Method of grading</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-FPA-112-m01</td>
<td>Visiting Research Project</td>
<td>10</td>
<td>NUM</td>
<td>120</td>
</tr>
<tr>
<td>11-EXN6A-112-m01</td>
<td>Current Topics in Nanostructure Technology</td>
<td>6</td>
<td>NUM</td>
<td>123</td>
</tr>
<tr>
<td>11-HLF-092-m01</td>
<td>Semiconductor Lasers - Principles and Current Research</td>
<td>6</td>
<td>NUM</td>
<td>48</td>
</tr>
<tr>
<td>11-HNS-092-m01</td>
<td>Semiconductor Nanostructures</td>
<td>6</td>
<td>NUM</td>
<td>54</td>
</tr>
<tr>
<td>11-NAN-092-m01</td>
<td>Nanoanalytics</td>
<td>6</td>
<td>NUM</td>
<td>56</td>
</tr>
<tr>
<td>11-NOP-092-m01</td>
<td>Nano-Optics</td>
<td>4</td>
<td>NUM</td>
<td>59</td>
</tr>
<tr>
<td>11-SPD-102-m01</td>
<td>Semiconductor Physics and Devices</td>
<td>6</td>
<td>NUM</td>
<td>83</td>
</tr>
<tr>
<td>11-QTH-102-m01</td>
<td>Quantum Transport in Semiconductor Nanostructures</td>
<td>6</td>
<td>NUM</td>
<td>85</td>
</tr>
<tr>
<td>11-TRI-102-m01</td>
<td>Spintronics</td>
<td>6</td>
<td>NUM</td>
<td>87</td>
</tr>
<tr>
<td>11-EXN5-111-m01</td>
<td>Current Topics in Nanostructure Technology</td>
<td>5</td>
<td>NUM</td>
<td>100</td>
</tr>
<tr>
<td>11-EXN6-111-m01</td>
<td>Current Topics in Nanostructure Technology</td>
<td>6</td>
<td>NUM</td>
<td>101</td>
</tr>
<tr>
<td>11-EXN7-111-m01</td>
<td>Current Topics in Nanostructure Technology</td>
<td>7</td>
<td>NUM</td>
<td>102</td>
</tr>
<tr>
<td>11-EXN8-111-m01</td>
<td>Current Topics in Nanostructure Technology</td>
<td>8</td>
<td>NUM</td>
<td>103</td>
</tr>
<tr>
<td>11-DFT-142-m01</td>
<td>Densitiy Functional Theory and the Physics of Oxide Heterostructure</td>
<td>4</td>
<td>NUM</td>
<td>139</td>
</tr>
</tbody>
</table>

#### Energy Research and Material Science

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Module title</th>
<th>ECTS credits</th>
<th>Method of grading</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-SAM-092-m01</td>
<td>Technology of Sensor and Actor Materials including Smart Fluids</td>
<td>5</td>
<td>NUM</td>
<td>32</td>
</tr>
<tr>
<td>11-OHL-092-m01</td>
<td>Organic Semiconductor</td>
<td>5</td>
<td>NUM</td>
<td>33</td>
</tr>
<tr>
<td>08-EEW-101-m01</td>
<td>Electrochemical Energy Storage and Conversion</td>
<td>5</td>
<td>NUM</td>
<td>37</td>
</tr>
<tr>
<td>11-FPA-112-m01</td>
<td>Visiting Research Project</td>
<td>10</td>
<td>NUM</td>
<td>120</td>
</tr>
<tr>
<td>11-EXN6A-112-m01</td>
<td>Current Topics in Nanostructure Technology</td>
<td>6</td>
<td>NUM</td>
<td>123</td>
</tr>
<tr>
<td>11-ENT-092-m01</td>
<td>Principles of Energy Technologies</td>
<td>6</td>
<td>NUM</td>
<td>46</td>
</tr>
<tr>
<td>11-TDO-092-m01</td>
<td>Thermodynamics and Economics</td>
<td>6</td>
<td>NUM</td>
<td>49</td>
</tr>
<tr>
<td>11-NTE-092-m01</td>
<td>Nanotechnology in Energy Research</td>
<td>4</td>
<td>NUM</td>
<td>88</td>
</tr>
<tr>
<td>11-BVG-092-m01</td>
<td>Coating Technologies based on Vapour Deposition</td>
<td>5</td>
<td>NUM</td>
<td>89</td>
</tr>
<tr>
<td>08-PCM4-PHY-111-m01</td>
<td>Ultrafast Spectroscopy and Quantum Control</td>
<td>5</td>
<td>NUM</td>
<td>97</td>
</tr>
<tr>
<td>08-MW-PHY-111-m01</td>
<td>Structure and Properties of Modern Materials: Experiments and Simulations</td>
<td>5</td>
<td>NUM</td>
<td>98</td>
</tr>
<tr>
<td>11-EXN5-111-m01</td>
<td>Current Topics in Nanostructure Technology</td>
<td>5</td>
<td>NUM</td>
<td>100</td>
</tr>
<tr>
<td>11-EXN6-111-m01</td>
<td>Current Topics in Nanostructure Technology</td>
<td>6</td>
<td>NUM</td>
<td>101</td>
</tr>
<tr>
<td>Module Code</td>
<td>Module Title</td>
<td>ECTS</td>
<td>Type</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>11-EXN7-111-m01</td>
<td>Current Topics in Nanostructure Technology</td>
<td>7</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-EXN8-111-m01</td>
<td>Current Topics in Nanostructure Technology</td>
<td>8</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-ZDR-111-m01</td>
<td>Principles of two- and three-dimensional Röntgen imaging</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-TDOE-141-m01</td>
<td>Thermodynamics and Economics</td>
<td>3</td>
<td>B/NB</td>
<td></td>
</tr>
<tr>
<td>11-ZMB-112-m01</td>
<td>Methods for non-destructive Characterization of Materials and Components</td>
<td>4</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-BSV-122-m01</td>
<td>Image and Signal Processing in Physics</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-BMS-121-m01</td>
<td>Imaging Methods at the Synchrotron</td>
<td>4</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-BMS-131-m01</td>
<td>Imaging Methods at the Synchrotron</td>
<td>4</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-BSV-131-m01</td>
<td>Image and Signal Processing in Physics</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-PMM-132-m01</td>
<td>Physics of Advanced Materials</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-QUT-132-m01</td>
<td>Quantum Information Technology</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td><strong>General Physics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-FPA-112-m01</td>
<td>Visiting Research Project</td>
<td>10</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-EXP6A-112-m01</td>
<td>Current Topics of Physics</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-ASL-092-m01</td>
<td>Applied Superconduction</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-EPP-092-m01</td>
<td>Introduction to Plasmaphysics</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-FK2-092-m01</td>
<td>Solid State Physics 2</td>
<td>8</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-FKS-092-m01</td>
<td>Solid State Spectroscopy</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-HLP-092-m01</td>
<td>Semiconductor Physics</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-MAG-092-m01</td>
<td>Magnetism</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-NDS-092-m01</td>
<td>Low-Dimensional Structures</td>
<td>4</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-QM2-092-m01</td>
<td>Quantum Mechanics II</td>
<td>8</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-QPM-092-m01</td>
<td>Quantum Phenomena in electronic correlated Materials</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-QVTP-092-m01</td>
<td>Many Body Quantum Theory</td>
<td>8</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-RMS-092-m01</td>
<td>Relativistic Effects in Mesoscopic Systems</td>
<td>5</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-TFK-092-m01</td>
<td>Theoretical Solid State Physics</td>
<td>8</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-TSL-092-m01</td>
<td>Theory of Superconduction</td>
<td>5</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-BMT-092-m01</td>
<td>Biophysical Measurement Technology in Medical Science</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-LMB-092-m01</td>
<td>Laboratory and Measurement Technology in Biophysics</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-PKS-092-m01</td>
<td>Physics of Complex Systems</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-QIC-092-m01</td>
<td>Quantum Information and Quantum Computing</td>
<td>5</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-SDC-092-m01</td>
<td>Statistics, Data Analysis and Computer Physics</td>
<td>4</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-A2-092-m01</td>
<td>Electronics</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-RMFT-102-m01</td>
<td>Renormalization Group Methods in Field Theory</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-MSS-102-m01</td>
<td>Methods in Surface Spectroscopy</td>
<td>4</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-EXE6-111-m01</td>
<td>Current Topics in Experimental Physics</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-EEW-102-m01</td>
<td>Electron Electron Interaction</td>
<td>4</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-TFK2-111-m01</td>
<td>Theoretical Solid State Physics 2</td>
<td>8</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-EXT6-111-m01</td>
<td>Current Topics in Theoretical Physics</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-EXP5-111-m01</td>
<td>Current Topics in Physics</td>
<td>5</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-EXP6-111-m01</td>
<td>Current Topics in Physics</td>
<td>6</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-EXP7-111-m01</td>
<td>Current Topics in Physics</td>
<td>7</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-EXP8-111-m01</td>
<td>Current Topics in Physics</td>
<td>8</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-IEM-111-m01</td>
<td>Introduction to Electron Microscopy</td>
<td>4</td>
<td>NUM</td>
<td></td>
</tr>
<tr>
<td>11-FTK-112-m01</td>
<td>Field Theory in Solid State Physics</td>
<td>8</td>
<td>NUM</td>
<td></td>
</tr>
</tbody>
</table>
### Module Catalogue for the Subject Nanostructure Technology

**Master's with 1 major, 120 ECTS credits**

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-CMS-122-m01</td>
<td>Computational Materials Science</td>
<td>8</td>
<td>NUM</td>
</tr>
<tr>
<td>11-CMS-131-m01</td>
<td>Computational Materials Science</td>
<td>8</td>
<td>NUM</td>
</tr>
<tr>
<td>11-ASL-131-m01</td>
<td>Applied Superconductivity</td>
<td>6</td>
<td>NUM</td>
</tr>
<tr>
<td>11-FKS2-132-m01</td>
<td>Solid State Spectroscopy 2</td>
<td>6</td>
<td>NUM</td>
</tr>
<tr>
<td>11-TFP-132-m01</td>
<td>Topology in Solid State Physics</td>
<td>6</td>
<td>NUM</td>
</tr>
</tbody>
</table>

**Non-technical Subsidiary Subjects (6 ECTS credits)**

**Mathematics**

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-M-ORS-072-m01</td>
<td>Operations Research</td>
<td>5</td>
<td>NUM</td>
</tr>
<tr>
<td>10-M-NM1-082-m01</td>
<td>Numerical Mathematics 1</td>
<td>8</td>
<td>NUM</td>
</tr>
<tr>
<td>10-M-NM2-082-m01</td>
<td>Numerical Mathematics 2</td>
<td>5</td>
<td>NUM</td>
</tr>
<tr>
<td>10-M-VAN-082-m01</td>
<td>Advanced Analysis</td>
<td>8</td>
<td>NUM</td>
</tr>
<tr>
<td>10-M-AAAN-102-m01</td>
<td>Applied Analysis</td>
<td>10</td>
<td>NUM</td>
</tr>
<tr>
<td>10-M-AFTH-102-m01</td>
<td>Complex Analysis</td>
<td>10</td>
<td>NUM</td>
</tr>
<tr>
<td>10-M-VGDS-102-m01</td>
<td>Groups and their Representations</td>
<td>10</td>
<td>NUM</td>
</tr>
<tr>
<td>10-M-VNPE-102-m01</td>
<td>Numeric of Partial Differential Equations</td>
<td>10</td>
<td>NUM</td>
</tr>
</tbody>
</table>

**Computer Science**

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-I-DB-102-m01</td>
<td>Databases</td>
<td>5</td>
<td>NUM</td>
</tr>
<tr>
<td>10-I-OOP-102-m01</td>
<td>Object-oriented Programming</td>
<td>5</td>
<td>NUM</td>
</tr>
<tr>
<td>10-I-AR-102-m01</td>
<td>Automation and Control Technology</td>
<td>8</td>
<td>NUM</td>
</tr>
<tr>
<td>10-I-BS-102-m01</td>
<td>Operating Systems</td>
<td>5</td>
<td>NUM</td>
</tr>
<tr>
<td>10-I-RAK-102-m01</td>
<td>Computer Architecture</td>
<td>5</td>
<td>NUM</td>
</tr>
<tr>
<td>10-I-PVS-102-m01</td>
<td>Programming of Distributed Systems</td>
<td>8</td>
<td>NUM</td>
</tr>
<tr>
<td>10-I-KI-102-m01</td>
<td>Artificial Intelligence</td>
<td>8</td>
<td>NUM</td>
</tr>
<tr>
<td>10-I-DB2-102-m01</td>
<td>Databases II</td>
<td>5</td>
<td>NUM</td>
</tr>
<tr>
<td>10-I-PA-102-m01</td>
<td>Program Design and Analysis</td>
<td>5</td>
<td>NUM</td>
</tr>
</tbody>
</table>

**Law**

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-N-P-H-082-m01</td>
<td>Fundamentals of Commercial Law</td>
<td>4</td>
<td>NUM</td>
</tr>
<tr>
<td>02-N-P-A-082-m01</td>
<td>Employment Law</td>
<td>4</td>
<td>NUM</td>
</tr>
<tr>
<td>02-N-P-G-082-m01</td>
<td>Introduction to Companies Law</td>
<td>2</td>
<td>NUM</td>
</tr>
<tr>
<td>02-N-P-W04-112-m01</td>
<td>European Company Law</td>
<td>2</td>
<td>NUM</td>
</tr>
<tr>
<td>02-N-P-G1-101-m01</td>
<td>Basic Course German Civil Code 1</td>
<td>10</td>
<td>NUM</td>
</tr>
<tr>
<td>02-N-P-G2-101-m01</td>
<td>Basic Course German Civil Code 2a and 2 b</td>
<td>10</td>
<td>NUM</td>
</tr>
<tr>
<td>02-N-P-G3-101-m01</td>
<td>Basic Course German Civil Code 3</td>
<td>10</td>
<td>NUM</td>
</tr>
<tr>
<td>02-N-P-W06-111-m01</td>
<td>German and European Trade Mark Law</td>
<td>3</td>
<td>NUM</td>
</tr>
<tr>
<td>02-N-P-W07-111-m01</td>
<td>Copyright Law and Fundamentals of Patent Law including references to EU Law</td>
<td>2</td>
<td>NUM</td>
</tr>
<tr>
<td>02-J7-112-m01</td>
<td>Employment law for non-law students</td>
<td>3</td>
<td>NUM</td>
</tr>
</tbody>
</table>

**Information Literacy**

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>41-IK-NW1-101-m01</td>
<td>Information Literacy for Students of the Natural Sciences (Basic Level)</td>
<td>2</td>
<td>B/NB</td>
</tr>
<tr>
<td>41-IK-NW2-101-m01</td>
<td>Information Literacy for Students of the Natural Sciences (Advanced Level)</td>
<td>2</td>
<td>B/NB</td>
</tr>
</tbody>
</table>

**Languages**

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>42-ENO-IK-072-m01</td>
<td>Intercultural Competence (English, Advanced Level)</td>
<td>3</td>
<td>NUM</td>
</tr>
<tr>
<td>42-ENO-LK-072-m01</td>
<td>Cultural Studies (English, Advanced Level)</td>
<td>3</td>
<td>NUM</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
<td>SEM</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------------------------------------</td>
<td>---------</td>
<td>-----</td>
</tr>
<tr>
<td>42-ENO-W1-072-m01</td>
<td>English for Business 1 (Advanced Level)</td>
<td>4</td>
<td>NUM 13</td>
</tr>
<tr>
<td>42-ENO-W2-072-m01</td>
<td>English for Business 2 (Advanced Level)</td>
<td>4</td>
<td>NUM 14</td>
</tr>
<tr>
<td>42-ENO-NW1-072-m01</td>
<td>English for the Natural Sciences 1 (Advanced Level)</td>
<td>4</td>
<td>NUM 27</td>
</tr>
<tr>
<td>42-ENO-NW2-072-m01</td>
<td>English for the Natural Sciences 2 (Advanced Level)</td>
<td>4</td>
<td>NUM 28</td>
</tr>
<tr>
<td>42-FRO-GW1-072-m01</td>
<td>French for the Humanities 1 (Advanced Level)</td>
<td>4</td>
<td>NUM 15</td>
</tr>
<tr>
<td>42-FRO-GW2-072-m01</td>
<td>French for the Humanities 2 (Advanced Level)</td>
<td>4</td>
<td>NUM 16</td>
</tr>
<tr>
<td>42-FRO-IK-072-m01</td>
<td>Intercultural Competence (French, Advanced Level)</td>
<td>3</td>
<td>NUM 17</td>
</tr>
<tr>
<td>42-FRO-LK-072-m01</td>
<td>Intercultural Competence (French, Advanced Level)</td>
<td>3</td>
<td>NUM 18</td>
</tr>
<tr>
<td>42-FRO-W1-072-m01</td>
<td>French for Business 1 (Advanced Level)</td>
<td>4</td>
<td>NUM 19</td>
</tr>
<tr>
<td>42-FRO-W2-072-m01</td>
<td>French for Business 2 (Advanced Level)</td>
<td>4</td>
<td>NUM 20</td>
</tr>
<tr>
<td>42-SPO-GW1-072-m01</td>
<td>Spanish for the Humanities 1 (Advanced Level)</td>
<td>4</td>
<td>NUM 21</td>
</tr>
<tr>
<td>42-SPO-GW2-072-m01</td>
<td>Spanish for the Humanities 2 (Advanced Level)</td>
<td>4</td>
<td>NUM 22</td>
</tr>
<tr>
<td>42-SPO-IK-072-m01</td>
<td>Intercultural Competence (Spanish, Advanced Level)</td>
<td>3</td>
<td>NUM 23</td>
</tr>
<tr>
<td>42-SPO-LK-072-m01</td>
<td>Cultural Studies (Spanish, Advanced Level)</td>
<td>3</td>
<td>NUM 24</td>
</tr>
<tr>
<td>42-SPO-W1-072-m01</td>
<td>Spanish for Business 1 (Advanced Level)</td>
<td>4</td>
<td>NUM 25</td>
</tr>
<tr>
<td>42-SPO-W2-072-m01</td>
<td>Spanish for Business 2 (Advanced Level)</td>
<td>4</td>
<td>NUM 26</td>
</tr>
</tbody>
</table>

**Additional Qualifications**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>SEM</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-EXNT6-112-m01</td>
<td>Non-technical Minor Subject</td>
<td>6</td>
<td>NUM 122</td>
<td></td>
</tr>
<tr>
<td>11-EXZ5-111-m01</td>
<td>Additional Qualifications for Engineers</td>
<td>5</td>
<td>NUM 113</td>
<td></td>
</tr>
<tr>
<td>11-EXZ6-111-m01</td>
<td>Additional Qualifications for Engineers</td>
<td>6</td>
<td>NUM 114</td>
<td></td>
</tr>
</tbody>
</table>

**Thesis (30 ECTS credits)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>SEM</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-MA-N-111-m01</td>
<td>Master Thesis Nanostructure Technology</td>
<td>30</td>
<td>NUM 115</td>
<td></td>
</tr>
</tbody>
</table>
## Operations Research

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations Research</td>
<td>10-M-ORS-072-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean of Studies Mathematik (Mathematics)</td>
<td>Institute of Mathematics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>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

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

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

V + Ü

### 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

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

§ 73 (1) 5. Mathematik Angewandte Mathematik
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Specialization Nanostructure Technology</td>
<td>11-FS-N-072-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>numerical grade</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td></td>
</tr>
</tbody>
</table>

**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**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Methods and Project Management Nanostructure Technology</td>
<td>11-MP-N-072-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>--</td>
</tr>
</tbody>
</table>

**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**

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

**Method of assessment**

Talk (approx. 30 to 45 minutes) with discussion

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
Module title: Intercultural Competence (English, Advanced Level)
Abbreviation: 42-ENO-IK-072-m01

Module coordinator: head of Language Centre (ZFS)
Module offered by: Language Centre (ZfS)

ECTS: 3
Method of grading: only after success completion of module(s)

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

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:
(No information on SWS (weekly contact hours) and course language available)

Method of assessment:
(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:
--

Referred to in LPO I (examination regulations for teaching-degree programmes):
--
Module title | Cultural Studies (English, Advanced Level) | Abbreviation | 42-ENO-LK-072-m01
Module coordinator | Language Centre (ZfS) or head of Language Centre (ZFS) | Module offered by | 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

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>English for Business 1 (Advanced Level)</td>
<td>42-ENO-W1-072-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>head of Language Centre (ZFS)</td>
<td>Language Centre (ZfS)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>42-ENM2 or 42-ENM3 or 42-ENM4 or assessment test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

**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

Assessment offered: once a year, winter semester

Language of assessment: English

**Allocation of places**

Number of places: 5-25. Places will be allocated by lot.

**Additional information**

--

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

--
### Module title

**English for Business 2 (Advanced Level)**

**Abbreviation**

42-ENO-W2-072-m01

### Module coordinator

head of Language Centre (ZFS)

### Language Centre (ZFS)

### ECTS

4

### Method of grading

numerical grade

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

42-ENM2 or 42-ENM3 or 42-ENM4 or assessment test

### Duration

1 semester

### Module level

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

(terminal exam. date and course language available)

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

Assessment offered: once a year, summer semester

Language of assessment: English

### Allocation of places

Number of places: 5-25. Places will be allocated by lot.

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
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)

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>42-FRM2 or 42-FRM3 or 42-FRM4 or assessment test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

### 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

Assessment offered: once a year, winter semester

Language of assessment: French

### Allocation of places

Number of places: 5-25. Places will be allocated by lot.

### Additional information

---

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

---
Module title: French for the Humanities 2 (Advanced Level)

Abbreviation: 42-FRO-GW2-072-m01

Module coordinator: head of Language Centre (ZFS)

Module offered by: Language Centre (ZfS)

ECTS: 4

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

Duration: 1 semester

Module level: undergraduate

Other prerequisites: --

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:
(No information on SWS (weekly contact hours) and course language available)

Method of assessment:
(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

Assessment offered: once a year, summer semester

Language of assessment: French

Allocation of places:
Number of places: 5-25. Places will be allocated by lot.

Additional information:
--

Referred to in LPO I (examination regulations for teaching-degree programmes):
--
Module title: Intercultural Competence (French, Advanced Level)

Abbreviation: 42-FRO-IK-072-m01

Module coordinator: head of Language Centre (ZfS)

Module offered by: Language Centre (ZfS)

ECTS: 3

Method of grading: numerical grade

Only after succ. compl. of module(s): 42-FRM2 or 42-FRM3 or 42-FRM4 or assessment test

Duration: 1 semester

Module level: undergraduate

Other prerequisites: --

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:

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

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

Method of assessment:

(No 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:

--

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

--
## Intercultural Competence (French, Advanced Level)

**Module title:** Intercultural Competence (French, Advanced Level)  
**Abbreviation:** 42-FRO-LK-072-m01

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>head of Language Centre (ZFS)</td>
<td>Language Centre (ZfS)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>numerical grade</td>
<td>42-FRM2 or 42-FRM3 or 42-FRM4 or assessment test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Type, number of weekly contact hours, language — if other than German</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ü (no information on SWS (weekly contact hours) and course language available)</td>
</tr>
</tbody>
</table>

### Method of assessment

<table>
<thead>
<tr>
<th>Type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>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</td>
</tr>
</tbody>
</table>

### Language of assessment: French

### Allocation of places

Number of places: 5-25. Places will be allocated by lot.

### Additional information

---

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

---
### Module: French for Business 1 (Advanced Level)

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>42-FRO-W1-072-m01</th>
</tr>
</thead>
</table>

#### Module coordinator
- head of Language Centre (ZFS)

#### Module offered by
- Language Centre (ZfS)

<table>
<thead>
<tr>
<th>ECTS</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method of grading</td>
<td>numerical grade</td>
</tr>
<tr>
<td>Only after succ. compl. of module(s)</td>
<td>42-FRM2 or 42-FRM3 or 42-FRM4 or assessment test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>1 semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module level</td>
<td>undergraduate</td>
</tr>
<tr>
<td>Other prerequisites</td>
<td>--</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Type, number of weekly contact hours, language — if other than German</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ü (no information on SWS (weekly contact hours) and course language available)</td>
</tr>
</tbody>
</table>

<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 can be chosen to earn a bonus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>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</td>
<td></td>
</tr>
</tbody>
</table>

Assessment offered: once a year, winter semester

Language of assessment: French

### Allocation of places

Number of places: 5-25. Places will be allocated by lot.

### Additional information

- Referred to in LPO 1 (examination regulations for teaching-degree programmes)
### French for Business 2 (Advanced Level)

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>French for Business 2 (Advanced Level)</strong></td>
<td>42-FRO-W2-072-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>head of Language Centre (ZFS)</td>
<td>Language Centre (ZfS)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>42-FRM2 or 42-FRM3 or 42-FRM4 or assessment test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

#### 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

<table>
<thead>
<tr>
<th>Type, number of weekly contact hours, language — if other than German</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ü (no information on SWS (weekly contact hours) and course language available)</td>
</tr>
</tbody>
</table>

#### Method of assessment

<table>
<thead>
<tr>
<th>Type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>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</td>
</tr>
</tbody>
</table>

Assessment offered: once a year, summer semester

Language of assessment: French

#### Allocation of places

Number of places: 5-25. Places will be allocated by lot.

#### Additional information

--

---

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

--

---
Spanish for the Humanities 1 (Advanced Level)  

42-SPO-GW1-072-m01

Module coordinator

head of Language Centre (ZFS)

Module offered by

Language Centre (ZfS)

ECTS

4

Method of grading

numerical grade

Only after succ. compl. of module(s)

42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test

Duration

1 semester

Module level

undergraduate

Other prerequisites

--

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

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

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

Method of assessment

(7, 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

Assessment offered: once a year, winter semester

Language of assessment: Spanish

Allocation of places

Number of places: 5-25. Places will be allocated by lot.

Additional information

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish for the Humanities 2 (Advanced Level)</td>
<td>42-SPO-GW2-072-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>head of Language Centre (ZFS)</td>
<td>Language Centre (ZfS)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

**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) |

<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 can be chosen to earn a bonus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>option 1: written multi-component examination (approx. 90 minutes total) with 4 components (reading comprehension, listening comprehension, writing, communication skills)</td>
<td></td>
</tr>
<tr>
<td>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)</td>
<td></td>
</tr>
<tr>
<td>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</td>
<td></td>
</tr>
</tbody>
</table>

Assessment offered: once a year, summer semester

Language of assessment: Spanish

**Allocation of places**

Number of places: 5-25. Places will be allocated by lot.

**Additional information**

--

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

--
### Module Catalogue for the Subject Nanostructure Technology

**Master's with 1 major, 120 ECTS credits**

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercultural Competence (Spanish, Advanced Level)</td>
<td>42-SPO-IK-072-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>head of Language Centre (ZFS)</td>
<td>Language Centre (ZfS)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>numerical grade</td>
<td>42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

### 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

--

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

--
**Module title**  
Cultural Studies (Spanish, Advanced Level)

**Abbreviation**  
42-SPO-LK-072-m01

**Module coordinator**  
head of Language Centre (ZFS)

**Module offered by**  
Language Centre (ZfS)

**ECTS**  
3

**Method of grading**  
numerical grade

**Only after succ. compl. of module(s)**  
42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test

**Duration**  
1 semester

**Module level**  
undergraduate

**Other prerequisites**  
--

---

**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**

--

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

--
Module title: Spanish for Business 1 (Advanced Level)  
Abbreviation: 42-SPO-W1-072-m01

Module coordinator: head of Language Centre (ZFS)  
Module offered by: Language Centre (ZFS)

ECTS: 4  
Method of grading: numerical grade  
Only after succ. compl. of module(s): 42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test

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

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
Assessment offered: once a year, winter semester
Language of assessment: Spanish

Allocation of places:
Number of places: 5-25. Places will be allocated by lot.

Additional information:
--

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

**Spanish for Business 2 (Advanced Level)**

### Abbreviation

42-SPO-W2-072-m01

### Module coordinator

head of Language Centre (ZFS)

### Module offered by

Language Centre (ZfS)

### ECTS

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>42-SPM2 or 42-SPM3 or 42-SPM4 or assessment test</td>
</tr>
</tbody>
</table>

### Duration

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Courses</th>
<th>(type, number of weekly contact hours, language — if other than German)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ü (no information on SWS (weekly contact hours) and course language available)</td>
<td></td>
</tr>
</tbody>
</table>

### Method of assessment

<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 can be chosen to earn a bonus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>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</td>
<td></td>
</tr>
</tbody>
</table>

Assessment offered: once a year, summer semester
Language of assessment: Spanish

### Allocation of places

| Allocation of places | Number of places: 5-25. Places will be allocated by lot. |

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
<table>
<thead>
<tr>
<th><strong>Module title</strong></th>
<th><strong>Abbreviation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>English for the Natural Sciences 1 (Advanced Level)</td>
<td>42-ENO-NW1-072-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Module coordinator</strong></th>
<th><strong>Module offered by</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>head of Language Centre (ZFS)</td>
<td>Language Centre (ZfS)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ECTS</strong></th>
<th><strong>Method of grading</strong></th>
<th><strong>Only after succ. compl. of module(s)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>42-ENM2 or 42-ENM3 or 42-ENM4 or assessment test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Duration</strong></th>
<th><strong>Module level</strong></th>
<th><strong>Other prerequisites</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

**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

Assessment offered: once a year, winter semester

Language of assessment: English

**Allocation of places**

Number of places: 5-25. Places will be allocated by lot.

**Additional information**

--

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

--
## Module Catalogue for the Subject
### Nanostructure Technology
#### Master's with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>English for the Natural Sciences 2 (Advanced Level)</td>
<td>42-ENO-NW2-072-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>head of Language Centre (ZFS)</td>
<td>Language Centre (ZfS)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>42-ENM2 or 42-ENM3 or 42-ENM4 or assessment test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

### 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

Assessment offered: once a year, summer semester

Language of assessment: English

### Allocation of places

Number of places: 5-25. Places will be allocated by lot.

### Additional information

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numerical Mathematics 1</td>
<td>10-M-NM1-082-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean of Studies Mathematik (Mathematics)</td>
<td>Institute of Mathematics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>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**

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**

--

**Additional information**

--

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

§ 73 (1) 5. Mathematik Angewandte Mathematik
Module title: Numerical Mathematics 2
Abbreviation: 10-M-NM2-082-m01

Module coordinator: Dean of Studies Mathematik (Mathematics)
Module offered by: Institute of Mathematics

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

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

Additional information:
--

Referred to in LPO I (examination regulations for teaching-degree programmes):
§ 73 (1) 5. Mathematik Angewandte Mathematik
Module title | Abbreviation
--- | ---
Advanced Analysis | 10-M-VAN-082-m01

Module coordinator | Module offered by
Dean of Studies Mathematik (Mathematics) | Institute of Mathematics

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

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

--

Additional information

--

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

§ 73 (1) 1. Mathematik Analysis
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology of Sensor and Actor Materials including Smart Fluids</td>
<td>08-SAM-092-m01</td>
</tr>
</tbody>
</table>

**Module coordinator**
holder of the Chair of Chemical Technology of Material Synthesis

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

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

**Duration**
1 semester

**Module level**
graduate

**Other prerequisites**
--

**Contents**

German contents available but not translated yet.


**Intended learning outcomes**

German intended learning outcomes available but not translated yet.

Der/Die Studierende verfügt über grundlegende Kenntnisse im Bereich der sensorischen und aktorischen Materialien.

**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**
--

**Additional information**
--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic Semiconductor</td>
<td>11-OHL-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</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**

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**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
### Module title
**Fundamentals of Commercial Law**

### Abbreviation
02-N-P-H-082-m01

### Module coordinator
Dean of Studies Faculty of Law

### Module offered by
Faculty of Law

### ECTS
4

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

### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
--

## 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.


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

## Method of assessment
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 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
--

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

--
### Module Catalogue for the Subject Nanostructure Technology

#### Master's with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment Law</td>
<td>02-N-P-A-082-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean of Studies Faculty of Law</td>
<td>Faculty of Law</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

### 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

(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 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

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
## Introduction to Companies Law

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Companies Law</td>
<td>02-N-P-G-082-m01</td>
</tr>
</tbody>
</table>

### Module coordinator
Dean of Studies Faculty of Law

### Module offered by
Faculty of Law

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

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

### Method of assessment
(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

---

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

---
Module title: Electrochemical Energy Storage and Conversion  
Abbreviation: 08-EEW-101-m01

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

ECTS: 5  
Method of grading: numerical grade  
Duration: 1 semester  
Module level: graduate

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

Intended learning outcomes: The students possess comprehensive knowledge in the field of electrochemical energy storage and transformation and are able to apply this to scientific problems.

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

Method of assessment: written examination (90 minutes) and lab report (approx. 5 pages)

Allocation of places: --

Additional information: --

Referred to in LPO I (examination regulations for teaching-degree programmes): --
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Databases</td>
<td>10-I-DB-102-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean of Studies Informatik (Computer Science)</td>
<td>Institute of Computer Science</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).</td>
</tr>
</tbody>
</table>

**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**

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

**Method of assessment**

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**

--

**Additional information**

--

**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
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object-oriented Programming</td>
<td>10-I-OOP-102-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean of Studies Informatik (Computer Science)</td>
<td>Institute of Computer Science</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).</td>
</tr>
</tbody>
</table>

**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**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
## Automation and Control Technology
### Abbreviation
10-I-AR-102-m01

### Module coordinator
holder of the Chair of Computer Science VII

### Module offered by
Institute of Computer Science

### ECTS
8

### Duration
1 semester

### Method of grading
numerical grade

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

### Module level
undergraduate

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

### Method of assessment
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
--

### Additional information
--

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

--
### Module Title
Operating Systems

### Abbreviation
10-I-BS-102-m01

### Module Coordinator
Holder of the Chair of Computer Science II

### Module Offered by
Institute of Computer Science

### ECTS
5

### Method of Grading
Numerical grade

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

### Duration
1 semester

### Module Level
Undergraduate

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

### Method of Assessment
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
--

### Additional Information
--

### Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 69 (1) 1. c) Informatik Technische Informatik
**Module title**  
Computer Architecture

**Abbreviation**  
10-I-RAK-102-m01

**Module coordinator**  
holder of the Chair of Computer Science V

**Module offered by**  
Institute of Computer Science

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

**Duration**  
1 semester

**Module level**  
undergraduate

**Other prerequisites**  
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**

--

**Additional information**

--

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

§ 69 (1) 1. c) Informatik Technische Informatik
### Module title
Information Literacy for Students of the Natural Sciences (Basic Level)

### Abbreviation
41-IK-NW1-101-m01

### Module coordinator
head of University Library

### Module offered by
University Library

### ECTS
2

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

### Duration
1 semester

### Module level
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
--

### Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Literacy for Students of the Natural Sciences (Advanced Level)</td>
<td>41-IK-NW2-101-m01</td>
</tr>
</tbody>
</table>

**Module coordinator**

head of University Library

**Module offered by**

University Library

**ECTS**

2

**Method of grading**

Only after succ. compl. of module(s)

**Duration**

1 semester

**Module level**

undergraduate

**Other prerequisites**

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. 5 exercises) 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

--

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

--
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


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

--

Additional information

--

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

--
### Module Catalogue for the Subject Nanostructure Technology

#### Master's with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principles of Energy Technologies</td>
<td>11-ENT-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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


### 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

--

### Additional information

--

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

--
**Module title**  
Introduction to Plasmaphysics

**Abbreviation**  
11-EPP-092-m01

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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**

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**

--

**Additional information**

--

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

--
### Module title
Semiconductor Lasers - Principles and Current Research

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semiconductor Lasers - Principles and Current Research</td>
<td>11-HLF-092-m01</td>
</tr>
</tbody>
</table>

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

### Module offered by
Faculty of Physics and Astronomy

### ECTS
6

### Method of grading

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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
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
--

### Additional information
--

### Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermodynamics and Economics</td>
<td>11-TDO-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Theoretical Physics and Astrophysics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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**

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
<table>
<thead>
<tr>
<th><strong>Allocation of places</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional information</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Referred to in LPO I</strong> (examination regulations for teaching-degree programmes)</td>
<td></td>
</tr>
</tbody>
</table>
Module title
Solid State Physics 2

Abbreviation
11-FK2-092-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
graduate

Other prerequisites
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

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
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
**Module title**: Solid State Spectroscopy  
**Abbreviation**: 11-FKS-092-m01

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

**ECTS**: 6  
**Method of grading**: numerical grade  
**Other prerequisites**: 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**  

**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**  
--

**Additional information**  
--

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

**Master’s with 1 major, 120 ECTS credits**

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semiconductor Physics</td>
<td>11-HLP-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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**


**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**

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

**Method of assessment**

(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**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
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**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetism</td>
<td>11-MAG-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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**

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**

--

**Additional information**

--

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

--
Module title
Nanoanalytics

Abbreviation
11-NAN-092-m01

Module coordinator
Managing Director of the Institute of Applied Physics

Module offered by
Faculty of Physics and Astronomy

ECTS
6

Method of grading
numerical grade

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

Duration
1 semester

Module level
graduate

Other prerequisites
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

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
--

Additional information
--

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

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

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

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

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
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantum Mechanics II</td>
<td>11-QM2-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Theoretical Physics and Astrophysics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>numerical grade</td>
<td>Only after succ. compl. of module(s)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td></td>
</tr>
</tbody>
</table>

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, Lorentz 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
<table>
<thead>
<tr>
<th>Allocation of places</th>
</tr>
</thead>
<tbody>
<tr>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Referred to in LPO I (examination regulations for teaching-degree programmes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>--</td>
</tr>
<tr>
<td>Module title</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>Quantum Phenomena in electronic correlated Materials</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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**

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**

--

**Additional information**

--

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

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

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

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

Duration: 1 semester
Module level: graduate
Other prerequisites: 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
--

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

---
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relativistic Effects in Mesoscopic Systems</td>
<td>11-RMS-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Theoretical Physics and Astrophysics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td>Only after succ. compl. of module(s)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>5</td>
</tr>
</tbody>
</table>

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**

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

**Method of assessment**

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**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
Module title | Theoretical Solid State Physics
--- | ---
Abbreviation | 11-TFK-092-m01

Managing Director of the Institute of Theoretical Physics and Astrophysics

Faculty of Physics and Astronomy

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

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

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
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory of Superconduction</td>
<td>11-TSL-092-m01</td>
</tr>
</tbody>
</table>

**Module coordinator**
Managing Director of the Institute of Theoretical Physics and Astrophysics

**Module offered by**
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**

**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**
--

**Additional information**
--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biophysical Measurement Technology in Medical Science</td>
<td>11-BMT-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>Only after succ. compl. of module(s)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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

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

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

### Method of assessment

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

--

### Additional information

--

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

--
Module title
Laboratory and Measurement Technology in Biophysics

Abbreviation
11-LMB-092-m01

Module coordinator
Managing Director of the Institute of Applied Physics

Module offered by
Faculty of Physics and Astronomy

ECTS
6

Method of grading
Numerical grade

Only after succ. compl. of module(s)

Duration
1 semester

Module level
Graduate

Other prerequisites
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
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
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 equilibrium
2. Introduction into the physics out of equilibrium
3. Entropy production and fluctuation
4. Phase transitions away from equilibrium
5. Universality
6. Spin glasses
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
--

Additional information
--

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

--

## Additional information

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistics, Data Analysis and Computer Physics</td>
<td>11-SDC-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>--</td>
<td>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

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

--

### Additional information

--

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

--
## Module Catalogue for the Subject Nanostructure Technology

### Master's with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming of Distributed Systems</td>
<td>10-I=PVS-102-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>holder of the Chair of Computer Science II</td>
<td>Institute of Computer Science</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Where applicable, prerequisites as specified by the lecturer at the beginning of the course (e. g. completion of exercises).</td>
</tr>
</tbody>
</table>

### 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

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

### Method of assessment

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

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Module title: Artificial Intelligence
Abbreviation: 10-I=KI-102-m01

Module coordinator: holder of the Chair of Computer Science VI
Module offered by: Institute of Computer Science

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

Duration: 1 semester
Module level: graduate
Other prerequisites: 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:
--

Additional information:
--

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

**Additional information**
--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Program Design and Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbreviation</td>
<td>10-l=PA-102-m01</td>
</tr>
<tr>
<td>Module coordinator</td>
<td>holder of the Chair of Computer Science II</td>
</tr>
<tr>
<td>Module offered by</td>
<td>Institute of Computer Science</td>
</tr>
<tr>
<td>ECTS</td>
<td>5</td>
</tr>
<tr>
<td>Method of grading</td>
<td>numerical grade</td>
</tr>
<tr>
<td>Only after succ. compl. of module(s)</td>
<td><code>--</code></td>
</tr>
<tr>
<td>Duration</td>
<td>1 semester</td>
</tr>
<tr>
<td>Module level</td>
<td>graduate</td>
</tr>
<tr>
<td>Other prerequisites</td>
<td>Where applicable, prerequisites as specified by the lecturer at the beginning of the course (e.g. completion of exercises).</td>
</tr>
<tr>
<td>Contents</td>
<td>Program analysis, model creation in software engineering, program quality, test of programs, process models.</td>
</tr>
<tr>
<td>Intended learning outcomes</td>
<td>The students are able to analyse programs, to use testing frameworks and metrics as well as to judge program quality.</td>
</tr>
<tr>
<td>Courses</td>
<td>V + Ü (no information on SWS (weekly contact hours) and course language available)</td>
</tr>
<tr>
<td>Method of assessment</td>
<td>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)</td>
</tr>
<tr>
<td>Language of assessment</td>
<td>German, English if agreed upon with the examiner</td>
</tr>
<tr>
<td>Allocation of places</td>
<td><code>--</code></td>
</tr>
<tr>
<td>Additional information</td>
<td><code>--</code></td>
</tr>
<tr>
<td>Referred to in LPO I</td>
<td>(examination regulations for teaching-degree programmes)</td>
</tr>
</tbody>
</table>
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

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 (go 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
--

Additional information
--

Referred to in LPO 1 (examination regulations for teaching-degree programmes)
--
Module title: Complex Analysis
Abbreviation: 10-M=AFTH-102-m01

Module coordinator: Dean of Studies Mathematik (Mathematics)
Module offered by: Institute of Mathematics
ECTS: 10
Method of grading: numerical grade
Duration: 1 semester
Module level: graduate
Other prerequisites: 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).

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
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups and their Representations</td>
<td>10-M=VGDS-102-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean of Studies Mathematik (Mathematics)</td>
<td>Institute of Mathematics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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.</td>
</tr>
</tbody>
</table>

**Contents**

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

**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**

--

**Additional information**

--

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

--
# Module Catalogue for the Subject Nanostructure Technology
## Master's with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numeric of Partial Differential Equations</td>
<td>10-M=VNPE-102-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean of Studies Mathematik (Mathematics)</td>
<td>Institute of Mathematics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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.</td>
</tr>
</tbody>
</table>

## 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).

## 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 (go 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
--

## Additional information
--

## Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantum Control and Quantum Computing</td>
<td>10-M=VQKC-102-m01</td>
</tr>
</tbody>
</table>

**Module coordinator**  
Dean of Studies Mathematik (Mathematics)  
Institute of Mathematics

**ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Duration</strong></th>
<th><strong>Module level</strong></th>
<th><strong>Other prerequisites</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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.</td>
</tr>
</tbody>
</table>

**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**  
--

**Additional information**  
--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)  
--
Module title | Abbreviation
---|---
Electronics | 11-A2-092-m01

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

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

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
Principles of electronic components and circuits. Analogous circuit technology: Passive (resistors, capacitors, coils and diodes) and active components (bipolar and field-effect transistors, operational amplifiers). Digital circuits: different types of gates and CMOS circuits. Microcontroller

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

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module title
Semiconductor Physics and Devices

Abbreviation
11-SPD-102-m01

Module coordinator
Managing Director of the Institute of Applied Physics

Module offered by
Faculty of Physics and Astronomy

ECTS
6

Method of grading
numerical grade

Duration
1 semester

Module level
graduate

Other prerequisites
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 Semiconductor Physics. Introduction to key theories on semiconductors. Components from the areas of electronics and photonics.

Intended learning outcomes
The students are familiar with the properties of semiconductors, they have gained an overview of the electronic and phononic band structures of important semiconductors and the resulting electronic, optical and thermal properties. They know the principles of charge transport and are able to apply Poisson, Boltzmann and continuity equations to the solution of questions. They have gained insights into the methods of semiconductor production and are familiar with the methods of planar technology and current developments in this sector, they have a basic understanding of component production. They understand the structure and function of the main components of electronics (diodes, transistor, FET, thyristor, diac, triac), microwave applications (tunnel, impatt, baritt and Gunn diode) and 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 importance. They are familiar with current developments in the field of components.

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

Method of assessment
written examination (approx. 90 minutes) or 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 project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or 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
--

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

--
### Contents

The lecture addresses the fundamental transport phenomena of electrons in nanostructures. This includes the topics of: ballistic and diffuse transport, electron interference effects, quantisation of conductivity, interaction phenomena between electrons, Coulomb blockade, thermoelectric properties, description of spin-dependent transport phenomena, topological insulators, solid-state 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

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

### Method of assessment

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

--

### Additional information

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renormalization Group Methods in Field Theory</td>
<td>11-RMFT-102-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Theoretical Physics and Astrophysics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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**

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**

--

**Additional information**

--

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

--
### Module Catalogue for the Subject
Module title: Spintronics
Abbreviation: 11-SPI-102-m01

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

### Module offered by
Faculty of Physics and Astronomy

### ECTS
6

### Method of grading
numerical grade

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

### Duration
1 semester

### Module level
graduate

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

### Method of assessment
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
--

### Additional information
--

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

**Master's with 1 major, 120 ECTS credits**

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nanotechnology in Energy Research</td>
<td>11-NTE-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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

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

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

### Method of assessment

(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

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
### Contents

Physical technical principles of PVD and CVD installations and processes. Coating deposit and layer characterisation. Application of layer materials on an industrial level.

### Intended learning outcomes

The students have advanced knowledge of coating deposit processes in the gaseous phase and gain insights into their industrial relevance and variety.

### 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

- 

### Additional information

- 

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

- 

---

**Module Catalogue for the Subject Nanostructure Technology**

**Master’s with 1 major, 120 ECTS credits**

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating Technologies based on Vapour Deposition</td>
<td>11-BVG-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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>

---

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

Faculty of Physics and Astronomy

---

---
Module title: Advanced Practical Course Master
Abbreviation: 11-PFM-111-m01

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

ECTS: 10
Method of grading: Only after succ. compl. of module(s)

Duration: 1 semester
Module level: graduate
Other prerequisites: --

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. The students are familiar with modern experimental methods. They are able to work on a task on the basis of publications, to conduct and evaluate an experiment and to present and discuss their results in a scientific publication.

Courses:
Prep seminar for Fortgeschrittenen-Praktikum Master (Advanced Practical Course Master): S (1 weekly contact hour)
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
Fortgeschrittenen-Praktikum Master (Advanced Practical Course Master) Part 3: P (3 weekly contact hours), German or English

Method of assessment:
This module has the following assessment components
1. Prep seminar for Fortgeschrittenen-Praktikum Master (Advanced Practical Course Master): oral examination (approx. 5 to 10 minutes)
2. 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).
3. 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).
4. Lab course in part 3 (Fortgeschrittenen-Praktikum Master/Advanced Practical Course Master Part 3): 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 through 4 online (details to be announced).
Only those students who have attended the prep seminar for Fortgeschrittenen-Praktikum Master (Advanced Practical Course Master) will be allowed to perform experiments as part of the courses Fortgeschrittenen-Praktikum Master Parts 1 through 3.
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 each of the assessment components 1 through 4.

<table>
<thead>
<tr>
<th>Allocation of places</th>
</tr>
</thead>
<tbody>
<tr>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Referred to in LPO I (examination regulations for teaching-degree programmes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>--</td>
</tr>
</tbody>
</table>
### Module title
Methods in Surface Spectroscopy

### Abbreviation
11-MSS-102-m01

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

### Module offered by
Faculty of Physics and Astronomy

### ECTS
4

### Method of grading
Numerical grade

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

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>Graduate</td>
<td>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
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
--

### Additional information
--

### Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Topics in Experimental Physics</td>
<td>11-EXE6-111-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Approval by examination committee required.</td>
</tr>
</tbody>
</table>

**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 Experimental Physics of the Master’s programme. They have knowledge of a current subdiscipline of Experimental Physics and understand the measuring and/or 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**

--

**Additional information**

--

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

--
### Module Catalogue for the Subject Nanostructure Technology

*Master's with 1 major, 120 ECTS credits*

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electron Electron Interaction</td>
<td>11-EEW-102-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Theoretical Physics and Astrophysics</td>
</tr>
</tbody>
</table>

**Module offered by**

Faculty of Physics and Astronomy

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

**Duration**

1 semester

**ECTS**

graduate

**Other prerequisites**

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 theory
2. 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**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical Solid State Physics 2</td>
<td>11-TFK2-111-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of</td>
<td>Faculty of Physics</td>
</tr>
<tr>
<td>Theoretical Physics and Astrophysics</td>
<td>and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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

- 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

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

### Method of assessment

- 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

--

### Additional information

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Topics in Theoretical Physics</td>
<td>11-EXT6-111-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Approval by examination committee required.</td>
</tr>
</tbody>
</table>

### Contents

Current topics of 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 Theoretical Physics of the Master’s programme. They have advanced specialist knowledge of a subdiscipline of Theoretical Physics and have mastered the required methods. They are able to apply the acquired methods to current problems 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. 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

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Module title
Ultrafast Spectroscopy and Quantum Control

Abbreviation
08-PCM4-PHY-111-m01

Module coordinator
Lecturer of the seminar "Ultrafast Spectroscopy and Quantum Control"

Module offered by
Institute of Physical and Theoretical Chemistry

ECTS
5

Method of grading
Numerical grade

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

Duration
1 semester

Module level
Graduate

Other prerequisites
--

Contents
German contents available but not translated yet.

Das Modul behandelt spezielle Themen der Ultrafast Spectroscopy and Quantum Control. Schwerpunkte sind ultrakurze Laserimpulse, zeitaufgelöste Laserspektroskopie sowie kohärente Kontrolle.

Intended learning outcomes
German intended learning outcomes available but not translated yet.


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
--

Additional information
--

Referred to in LPO 1 (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Structure and Properties of Modern Materials: Experiments and Simulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbreviation</td>
<td>08-MW-PHY-111-m01</td>
</tr>
<tr>
<td>Module coordinator</td>
<td>holder of the Chair of Chemical Technology of Material Synthesis</td>
</tr>
<tr>
<td>Module offered by</td>
<td>Chair of Chemical Technology of Material Synthesis</td>
</tr>
<tr>
<td>ECTS</td>
<td>5</td>
</tr>
<tr>
<td>Method of grading</td>
<td>numerical grade</td>
</tr>
<tr>
<td>Duration</td>
<td>1 semester</td>
</tr>
<tr>
<td>Module level</td>
<td>graduate</td>
</tr>
<tr>
<td>Contents</td>
<td>German contents available but not translated yet.</td>
</tr>
<tr>
<td>Intended learning outcomes</td>
<td>German intended learning outcomes available but not translated yet.</td>
</tr>
<tr>
<td>Courses</td>
<td>V + S (no information on SWS (weekly contact hours) and course language available)</td>
</tr>
<tr>
<td>Method of assessment</td>
<td>talk (approx. 45 minutes)</td>
</tr>
<tr>
<td>Allocation of places</td>
<td>--</td>
</tr>
<tr>
<td>Additional information</td>
<td>--</td>
</tr>
<tr>
<td>Referred to in LPO I</td>
<td>(examination regulations for teaching-degree programmes)</td>
</tr>
<tr>
<td>Module title</td>
<td>Abbreviation</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Advanced Seminar Nanostructure Technology</td>
<td>11-OSN-111-m01</td>
</tr>
</tbody>
</table>

**Module coordinator**

Managing Directors of the Institute of Applied Physics and the Institute of Theoretical Physics and Astrophysics

**Module offered by**

Faculty of Physics and Astronomy

**Duration**

1 semester

**Module level**

graduate

**Other prerequisites**

--

**Contents**

Seminar on current issues of Theoretical or Experimental Physics.

**Intended learning outcomes**

The students have advanced knowledge of a current specialist field of Experimental or Theoretical Physics. They are able to extract knowledge from professional publications and to summarise this knowledge and present it to a professional audience.

**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 with discussion (approx. 30 to 45 minutes)

Language of assessment: German, English

**Allocation of places**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Topics in Nanostructure Technology</td>
<td>11-EXN5-111-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Approval by examination committee required.</td>
</tr>
</tbody>
</table>

**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**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
# Current Topics in Nanostructure Technology

**Module title**: Current Topics in Nanostructure Technology  
**Abbreviation**: 11-EXN6-111-m01  
**Module coordinator**: chairperson of examination committee  
**Module offered by**: Faculty of Physics and Astronomy  
**ECTS**: 6  
**Method of grading**: numerical grade  
**Duration**: 1 semester  
**Module level**: graduate  
**Other prerequisites**: 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of weekly contact hours, language (if other than German)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V + R</td>
<td>—</td>
</tr>
</tbody>
</table>

## Method of assessment
(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

—

## Additional information

—

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

—
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Topics in Nanostructure Technology</td>
<td>11-EXN7-111-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>numerical grade</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Approval by examination committee required.</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Type, number of weekly contact hours, language — if other than German</th>
</tr>
</thead>
<tbody>
<tr>
<td>V + R (no information on SWS (weekly contact hours) and course language available)</td>
</tr>
</tbody>
</table>

### Method of assessment

<table>
<thead>
<tr>
<th>Type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>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)</td>
</tr>
</tbody>
</table>

Language of assessment: German, English

### Allocation of places

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Topics in Nanostructure Technology</td>
<td>11-EXN8-111-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Approval by examination committee required.</td>
</tr>
</tbody>
</table>

**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**

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

**Method of assessment**

(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**

--

**Additional information**

--

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

--
Module title: Current Topics in Physics
Abbreviation: 11-EXP5-111-m01

Module coordinator: chairperson of examination committee
Module offered by: Faculty of Physics and Astronomy

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

Duration: 1 semester
Module level: graduate
Other prerequisites: 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: --

Additional information: --

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

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

**Method of assessment**

(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**

--

**Additional information**

--

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

--
Module title: Current Topics in Physics  
Abbreviation: 11-EXP7-111-m01

Module coordinator: chairperson of examination committee  
Module offered by: Faculty of Physics and Astronomy

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

Duration: 1 semester  
Module level: graduate  
Other prerequisites: 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.

Intented 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

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

--

Additional information

--

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

--
<table>
<thead>
<tr>
<th><strong>Module title</strong></th>
<th><strong>Abbreviation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Topics in Physics</td>
<td>11-EXP8-111-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Module coordinator</strong></th>
<th><strong>Module offered by</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ECTS</strong></th>
<th><strong>Method of grading</strong></th>
<th><strong>Only after succ. compl. of module(s)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Duration</strong></th>
<th><strong>Module level</strong></th>
<th><strong>Other prerequisites</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Approval by examination committee required.</td>
</tr>
</tbody>
</table>

**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**

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

**Method of assessment**

(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**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Course German Civil Code 1</td>
<td>02-N-P-G1-101-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean of Studies Faculty of Law</td>
<td>Faculty of Law</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>numerical grade</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>Admission prerequisite to assessment: regular attendance of conversatorium.</td>
</tr>
</tbody>
</table>

### 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.


### Courses

<table>
<thead>
<tr>
<th>(type, number of weekly contact hours, language — if other than German)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V + 0 (no information on SWS (weekly contact hours) and course language available)</td>
</tr>
</tbody>
</table>

### 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

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

**Basic Course German Civil Code 2a and 2 b**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>02-N-P-G2-101-m01</th>
</tr>
</thead>
</table>

### Module Coordinator

Dean of Studies Faculty of Law

### Module Offered by

Faculty of Law

### ECTS

<table>
<thead>
<tr>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>numerical grade</td>
</tr>
</tbody>
</table>

### Duration

1 semester

### Module Level

Undergraduate

### Other Prerequisites

--

### 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.


### Courses

<table>
<thead>
<tr>
<th>Type, number of weekly contact hours, language — if other than German</th>
</tr>
</thead>
<tbody>
<tr>
<td>V + V (no information on SWS (weekly contact hours) and course language available)</td>
</tr>
</tbody>
</table>

### Method of Assessment

<table>
<thead>
<tr>
<th>Type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>written examination (approx. 120 minutes)</td>
</tr>
</tbody>
</table>

### 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 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

--

### Referred to in LPO I

(Examination regulations for teaching-degree programmes)
### Basic Course German Civil Code 3

**Module title**
Basic Course German Civil Code 3

**Abbreviation**
02-N-P-G3-101-m01

**Module coordinator**
Dean of Studies Faculty of Law

**Module offered by**
Faculty of Law

**ECTS** 10  
**Method of grading** numerical grade

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

**Duration** 1 semester  
**Module level** undergraduate  
**Other prerequisites** 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**
V + 0 (no information on SWS (weekly contact hours) and course language available)

**Method of assessment**
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 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**
--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
Module title
German and European Trade Mark Law

Abbreviation
02-N-P-W06-111-m01

Module coordinator
Dean of Studies Faculty of Law

Module offered by
Faculty of Law

ECTS
3

Method of grading
numerical grade

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

Duration
1 semester

Module level
undergraduate

Other prerequisites
--

Contents

German contents available but not translated yet.


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 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

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copyright Law and Fundamentals of Patent Law including references to EU Law</td>
<td>02-N-P-W07-111-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean of Studies Faculty of Law</td>
<td>Faculty of Law</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

**Contents**

German contents available but not translated yet.


**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 Regeln 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**

--

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

--
**Module title**  
Additional Qualifications for Engineers

**Abbreviation**  
11-EXZ5-111-m01

**Module coordinator**  
Chairperson of examination committee

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

**ECTS**  
5

**Method of grading**  
Numerical grade

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

**Duration**  
1 semester

**Module level**  
Graduate

**Other prerequisites**  
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**  
--

**Additional information**  
--

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

--
### Additional Qualifications for Engineers

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional Qualifications for Engineers</td>
<td>11-EXZ6-111-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Approval by examination committee required.</td>
</tr>
</tbody>
</table>

### 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

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master Thesis Nanostructure Technology</td>
<td>11-MA-N-111-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>--</td>
</tr>
</tbody>
</table>

**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

Language of assessment: German, English

**Allocation of places**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment law for non-law students</td>
<td>02-J7-112-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>holder of the Chair of Civil Law, Employment and Labour Law and Civil Procedure</td>
<td>Faculty of Law</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>--</td>
</tr>
</tbody>
</table>

**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**

--

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

--
Module title: Principles of two- and threedimensional Röntgen imaging

Abbreviation: 11-ZDR-111-m01

Module coordinator: Managing Director of the Institute of Applied Physics

Module offered by: Faculty of Physics and Astronomy

ECTS: 6

Method of grading: numerical grade

Duration: 1 semester

Module level: graduate

Other prerequisites: 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

Additional information

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

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
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Theory in Solid State Physics</td>
<td>11-FTFK-112-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Theoretical Physics and Astrophysics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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**

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**

--

**Additional information**

--

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

--
### Visiting Research Project

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visiting Research Project</td>
<td>11-FPA-112-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>numerical grade</td>
<td>Approval by examination committee required.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
</tr>
</tbody>
</table>

**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**

- --

**Additional information**

- Additional information on module duration: 1 to 2 semesters.
- Referred to in LPO I (examination regulations for teaching-degree programmes)
  - --
### Module title
European Company Law

### Abbreviation
02-N-P-W04-112-m01

### Module coordinator
Dean of Studies Faculty of Law

### Module offered by
Faculty of Law

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
--

### 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.


### 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 re-allocated as they become available.

### Additional information
--

### Referred to in LPO I (examination regulations for teaching-degree programmes)
--
### Module Catalogue for the Subject
Nanostructure Technology
Master's with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-technical Minor Subject</td>
<td>11-EXNT6-112-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Approval by examination committee required.</td>
</tr>
</tbody>
</table>

### 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

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

### Method of assessment

<table>
<thead>
<tr>
<th>Type</th>
<th>Scope</th>
<th>Language</th>
<th>Examination offered</th>
<th>Whether module can be chosen to earn a bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) written examination</td>
<td>approx. 120 minutes</td>
<td>German, English</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>b) oral examination of one candidate each</td>
<td>oral examination in groups (approx. 30 minutes per candidate)</td>
<td>German, English</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks)</td>
<td>German, English</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>d) presentation/seminar presentation (approx. 30 minutes)</td>
<td>German, English</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
</tbody>
</table>

Language of assessment: German, English

### Allocation of places

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
**Module title**  
Current Topics in Nanostructure Technology  
**Abbreviation**  
11-EXN6A-112-m01

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Approval by examination committee required.</td>
</tr>
</tbody>
</table>

**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) 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**

--

**Additional information**

--

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

--
### Module Catalogue for the Subject
**Nanostructure Technology**

**Master’s with 1 major, 120 ECTS credits**

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Topics of Physics</td>
<td>11-EXP6A-112-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>chairperson of examination committee</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Approval by examination committee required.</td>
</tr>
</tbody>
</table>

**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**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods for non-destructive Characterization of Materials and Components</td>
<td>11-ZMB-112-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>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

Methods of non-destructive material and component characterisation.

Intended learning outcomes

The students know methods of non-destructive characterisation of materials and 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) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 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

--

Additional information

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image and Signal Processing in Physics</td>
<td>11-BSV-122-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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

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

--

### Additional information

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imaging Methods at the Synchrotron</td>
<td>11-BMS-121-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>Only after succ. compl. of module(s)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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


### 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

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

### Method of assessment

(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

--

### Additional information

--

---

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

--
# Computational Materials Science

**Abbreviation** 11-CMS-122-m01

**Module coordinator** Managing Director of the Institute of Theoretical Physics and Astrophysics

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

**ECTS** 8

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

**Duration** 1 semester

**Module level** graduate

**Other prerequisites** 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

--

## Additional information

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

---
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computational Materials Science</td>
<td>11-CMS-131-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Theoretical Physics and Astrophysics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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.</td>
</tr>
</tbody>
</table>

**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**

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**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imaging Methods at the Synchrotron</td>
<td>11-BMS-131-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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.</td>
</tr>
</tbody>
</table>

**Contents**


**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**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image and Signal Processing in Physics</td>
<td>11-BSV-131-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>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.</td>
</tr>
</tbody>
</table>

**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**

--

**Additional information**

--

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

--
Module title: Applied Superconduction
Abbreviation: 11-ASL-131-m01

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

ECTS: 6
Method of grading: numerical grade
Other prerequisites: Only after succ. compl. of module(s)
Duration: 1 semester
Module level: graduate

Other prerequisites: 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

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)
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
--

Additional information
--

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

### Master's with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid State Spectroscopy 2</td>
<td>11-FKS2-132-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>--</td>
</tr>
</tbody>
</table>

### 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

--

### Additional information

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics of Advanced Materials</td>
<td>11-PMM-132-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td></td>
</tr>
</tbody>
</table>

**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**

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**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topology in Solid State Physics</td>
<td>11-TFP-132-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>--</td>
</tr>
</tbody>
</table>

**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**

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

**Method of assessment**

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**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
### Module title
Quantum Information Technology

### Abbreviation
11-QUI-132-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)

### Duration
1 semester

### Module level
graduate

### Other prerequisites
--

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

### Method of assessment
(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
--

### Additional information
--

### Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module title | Abbreviation
---|---
Thermodynamics and Economics | 11-TDOE-141-m01

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

--

Additional information

--

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

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

**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**

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

**Method of assessment**

(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**

--

**Additional information**

--

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

--