Module Catalogue
for the Subject
Didactics in Physics (Middle School)
as Didaktikfach
with the degree "Erste Staatsprüfung für das Lehramt an Mittelschulen"

Examination regulations version: 2020
Responsible: Faculty of Physics and Astronomy
## Contents

The subject is divided into

Abbreviations used, Conventions, Notes, In accordance with

Compulsory Courses

- Physics Teaching Concepts
- Physics 1 for Primary and Secondary General School
- Physics 2 for Primary and Secondary General School
- Physics 3 for Primary and Secondary General School

Extra Skills

Physics

- Teaching Seminar Fundamental Principles
- Selected Topics in Physics Didactics
- MINT Preparatory Course Mathematical Methods of Physics
- Student Lab Supervision (Physics)
- Low Cost - High Impact. Low-budget Experiments for Science Courses (Physics)
- Teaching Science with Hands-on-Exhibits (Physics)
- Astrophysics
- Principles of Energy Technologies
- Current Topics of Teaching Concepts in Physics
- Scientific Work in Teaching Concepts
- Current Topics in Physics
- Selected Topics of Physics

Thesis

- Thesis in Physics Secondary General School
The subject is divided into

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<th>ECTS credits</th>
<th>starting page</th>
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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:

LASPO2015

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

19-Feb-2020 (2020-20)

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

Successful completion of modules worth 20 ECTS credits in each subject selected as Didaktikfach (subject studied with a focus on teaching methodology) is a prerequisite for admission to the Erste Staatsprüfung (First State Examination) in the subject Didaktiken einer Fächergruppe der Mittelschule (Didactics of a Group of Subjects of Mittelschule).
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<td>Physics Teaching Concepts</td>
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<td>V (2) + V (2) + Ü (1)</td>
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<td>§ 53 l Nr. 2</td>
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<td>1 semester</td>
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**Contents**

Physical contents (mechanics, thermodynamics) relevant to classes in Natural Sciences or technical-natural sciences in Grund- and Hauptschule.

**Intended learning outcomes**

Qualitative knowledge of the physical principles of school-relevant contents of scientific or technical-scientific classes in Grund- and Hauptschule; knowledge of typical approaches to the implementation and evaluation of demonstration and pupils experiments.

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

V (3) + Ü (1)

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

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 15 minutes per candidate)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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

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§ 38 I Nr. 1
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### Contents
Physical contents (science of electricity, electronics) relevant to classes in Natural Sciences or technical-natural sciences in Grund- and Hauptschule.

### Intended learning outcomes
Qualitative knowledge of the physical principles of school-relevant contents of scientific or technical-scientific classes in Grund- and Hauptschule; knowledge of typical approaches to the implementation and evaluation of demonstration and pupils experiments.

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

- V (3) + Ü (1)

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

- a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 15 minutes per candidate)

Language of assessment: German and/or English

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

- § 36 I Nr. 7
- § 38 I Nr. 1
### Module Catalogue for the Subject
Didactics in Physics (Middle School)
LA Mittelschulen

<table>
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<td>Physics 3 for Primary and Secondary General School</td>
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**Module coordinator**
holder of the Chair of Physics and its Didactics

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

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**Duration**
1 semester

**Module level**
undergraduate

**Other prerequisites**
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### Contents
Physical contents (optics, acoustics, Atomic and Nuclear Physics) relevant to classes in Natural Sciences or technical-natural sciences in Grund- and Hauptschule.

### Intended learning outcomes
Qualitative knowledge of the physical principles of school-relevant contents of scientific or technical-scientific classes in Grund- and Hauptschule; knowledge of typical approaches to the implementation and evaluation of demonstration and pupils experiments.

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

| V (3) + Ü (1) |

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

| a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 15 minutes per candidate) |
| Language of assessment: German and/or English |

### Allocation of places
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### Additional information
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### Referred to in LPO 1 (examination regulations for teaching-degree programmes)

| § 36 I Nr. 7 |
| § 38 I Nr. 1 |
Extra Skills
(0-15 ECTS credits)

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

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

(Freier Bereich (general as well as subject-specific electives) -- subject specific)
<table>
<thead>
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<th>Module title</th>
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<tr>
<td>Teaching Seminar Fundamental Principles</td>
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<td>1 semester</td>
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</table>

**Contents**

Physical and interdisciplinary aspects of selected topics of physics education, corresponding student preconceptions and typical learning difficulties, elementarisation and didactic reconstruction of physical contents based on specific contents of physics education, verbalisation of physical contents, possible teaching methods, typical school experiments and suitable media.

**Intended learning outcomes**

Advanced, qualitative knowledge of school-relevant areas of Physics; knowledge of common methods, typical student preconceptions and special media on relevant topics; awareness of the differences between teaching Physics at university and school regarding contents and methods.

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

<table>
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<th>S (2)</th>
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**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) term paper (approx. 8 pages) or b) presentation (approx. 45 minutes) or c) written examination (approx. 45 minutes) or d) oral examination of one candidate each (approx. 15 minutes) or e) oral examination in groups (groups of 2, approx. 15 minutes per candidate)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
§ 22 II Nr. 3 f)
### Module title

**Selected Topics in Physics Didactics**

### Abbreviation

11-L-EL2-152-m01

### Module coordinator

Managing Director of the Institute of Applied Physics

### Module offered by

Faculty of Physics and Astronomy

### ECTS

3

### Method of grading

Only after succ. compl. of module(s)

### (not) successfully completed

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### Duration

1 semester

### Module level

undergraduate

### Other prerequisites

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### Contents

Current topics in physics education.

### Intended learning outcomes

The students have knowledge of a current subdiscipline of physics education and are able to classify the acquired knowledge according to subject-specific contexts and implement it into classes.

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

S (2)

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

- a) term paper (approx. 8 pages) or b) presentation (approx. 45 minutes) or c) written examination (approx. 45 minutes) or d) oral examination of one candidate each (approx. 15 minutes) or e) oral examination in groups (groups of 2, approx. 15 minutes per candidate)

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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

- § 22 II Nr. 1 h)
- § 22 II Nr. 2 f)
- § 22 II Nr. 3 f)
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<tr>
<td>1 semester</td>
<td>undergraduate</td>
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**Contents**

Mathematical basics and elementary calculus refreshing and extending knowledge from school, especially as an introduction and preparation for the modules of experimental and theoretical physics.

1. Basic geometry and algebra, 2. differential calculus and series, 3. integral calculus, 4. vectors – directional quantities, 5. coordinate systems, 6. complex numbers

**Intended learning outcomes**

Students are in command of knowledge of basic mathematics and possess skills in elementary calculus as required for the successful start into the studies of experimental and theoretical physics.

**Courses**

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

V (1) + Ü (2)

Module taught in: German or English

**Method of assessment**

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

exercises (successful completion of approx. 50% of approx. 6 exercise sheets) or talk (approx. 15 minutes)

Assessment offered: Once a year, winter semester

**Allocation of places**

- -

**Additional information**

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

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
§ 22 II Nr. 3 f)
### Module Catalogue for the Subject Didactics in Physics (Middle School)

**LA Mittelschulen**

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<th>Module title</th>
<th>Abbreviation</th>
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<td>Student Lab Supervision (Physics)</td>
<td>11-L-L3B-152-m01</td>
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#### Module coordinator
holder of the Chair of Physics and its Didactics

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

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#### Contents
The module provides an introduction to successful supervision of pupils independently carrying out experiments in the teaching-learning-laboratory.

#### Intended learning outcomes
The students learn to classify different groups of pupils according to their subject-specific and experimental level of performance, to support the pupils according to their needs and age and to help them during independent experimenting (supervision competencies in open classroom situations). The students are able to methodically and critically evaluate their own actions. A lecturer gives individual feedback to the students to avoid negative behaviour patterns and to support the students’ strengths. The students develop professional behaviour patterns by repeatedly working on the same topic with different groups of pupils (reflection competencies and self-control competencies).

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

**P (2)**

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

- a) written examination (approx. 45 minutes) or
- b) oral examination of one candidate each (approx. 10 minutes) or
- c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) or
- d) term paper (approx. 8 pages)

#### Allocation of places
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#### Additional information
This module is designed for students studying at least one subject in the natural sciences.

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

- § 22 II Nr. 1 h)
- § 22 II Nr. 2 f)
- § 22 II Nr. 3 f)
<table>
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<td>Low Cost - High Impact. Low-budget Experiments for Science Courses (Physics)</td>
<td>11-MIND-Ph1-152-m01</td>
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**Contents**

Conception and realisation of experimental stations with ordinary and inexpensive consumables for classes of Grundschule and secondary level I.

**Intended learning outcomes**

The students develop simple scientific experimenting stations to use for the transition from primary to secondary level I for small groups from different types of schools. In doing so, they learn to simplify and convey scientific contents relevant to the curriculum in due consideration of the target group.

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

S (2)

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

a) written examination (approx. 45 minutes) or b) oral examination of one candidate each (approx. 10 minutes) or c) oral examination in groups (groups of 2, approx. 20 minutes) or d) term paper (approx. 8 pages)

**Allocation of places**

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**Additional information**

This module is designed for students studying at least one subject in the natural sciences.

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

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
§ 22 II Nr. 3 f)
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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**Contents**

Designing and creating hands-on exhibits for STEM subjects.

**Intended learning outcomes**

The students evaluate the advantages and disadvantages of the hands-on approach for teaching scientific contents in and out of school. They plan and implement an interdisciplinary science exhibition as an example of project-oriented work with pupils of secondary level I and II.

**Courses**

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

S (2)

**Method of assessment**

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

a) written examination (approx. 45 minutes) or b) oral examination of one candidate each (approx. 10 minutes) or c) oral examination in groups (groups of 2, approx. 20 minutes) or d) term paper (approx. 8 pages)

**Allocation of places**

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**Additional information**

This module is designed for students studying at least one subject in the natural sciences.

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

§ 22 II Nr. 1 h) § 22 II Nr. 2 f) § 22 II Nr. 3 f)
### Module title

Astrophysics

### Abbreviation

11-AP-152-m01

### Module coordinator

Managing Director of the Institute of Theoretical Physics and Astrophysics

### Module offered by

Faculty of Physics and Astronomy

### ECTS

6

### Method of grading

Numerical grade

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

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### Duration

1 semester

### Module level

Undergraduate

### Other prerequisites

--

### Contents

History of astronomy, coordinates and time measurement, the Solar System, exoplanets, astronomical scales, telescopes and detectors, stellar structure and atmospheres, stellar evolution and end stages, interstellar medium, molecular clouds, structure of the Milky Way, the local universe, the expanding universe, galaxies, active galactic nuclei, large-scale structures, cosmology.

### Intended learning outcomes

The students are familiar with the modern world view of Astrophysics. They know methods and tools for astrophysical observations and evaluations. They are able to use these methods to plan and analyse own observations. They are familiar with the physics and development of the main astrophysical objects such as stars and galaxies.

### Courses

(V (2) + R (2))

Module taught in: German or English

### Method of assessment

a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).

If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

§ 22 II Nr. 1 h)  
§ 22 II Nr. 2 f)  
§ 22 II Nr. 3 f)
Module title | Abbreviation
--- | ---
Principles of Energy Technologies | 11-ENT-152-m01

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

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

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)

V (3) + R (1)

Module taught in: German or English

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

a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).

If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.

Assessment offered: Once a year, winter semester

Language of assessment: German and/or English

Allocation of places

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Additional information

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

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
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**Contents**

Current topics in physics education.

**Intended learning outcomes**

The students have knowledge of a current subdiscipline of physics education and are able to classify the acquired knowledge according to subject-specific contexts and implement it into classes.

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

| S (2) | Module taught in: German or English |

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

a) written examination (approx. 45 minutes) or b) oral examination of one candidate each (approx. 10 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) or d) term paper (approx. 8 pages) or e) talk (30 to 45 minutes) with discussion

**Allocation of places**

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**Additional information**

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

§ 22 II Nr. 1 h)  
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**Contents**

Current topics in scientific work in physics education

**Intended learning outcomes**

The students have knowledge of a current subdiscipline of physics education and are able to process questions of physics education on the basis of scientific methods.

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

- S (2)
  Module taught in: German or English

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

- talk (30 to 45 minutes)

**Allocation of places**

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**Additional information**

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

- § 22 II Nr. 1 h)
- § 22 II Nr. 2 f)
- § 22 II Nr. 3 f)
Module title

Current Topics in Physics

Abbreviation

11-LX6-152-m01

Module coordinator

chairperson of examination committee

Module offered by

Faculty of Physics and Astronomy

ECTS

6

Duration

1 semester

Method of grading

numerical grade

Only after succ. compl. of module(s)

Module level

undergraduate

Other prerequisites

Approval from examination committee required.

Contents

Current topics in physics.

Intended learning outcomes

The students 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 (3) + R (1)

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

a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).

If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.

Language of assessment: German and/or English

Allocation of places

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Additional information

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

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
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**Contents**

Current topics in experimental physics. Credited 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 Bachelor'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 (2) + R (1)

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

a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).

If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
§ 22 II Nr. 3 f)
Thesis
(10 ECTS credits)

Preparation of a written Hausarbeit (thesis) in accordance with the provisions of Section 29 LPO I (ex-
amination regulations for teaching-degree programmes) is a prerequisite for teaching degree students
to be admitted to the Erste Staatsprüfung (First State Examination). In accordance with the provisions
of Section 29 LPO I, students studying for a teaching degree Mittelschule may write this thesis in the
subject Didaktik einer Fächergruppe der Mittelschule (Didactics of a Group of Subjects of Mittelschule),
in the subject they selected as Unterrichtsfach (subject studied with a focus on the scientific discipline)
or in the subject Erziehungswissenschaften (Educational Science). Pursuant to Section 29 Subsection 1
Sentence 2 LPO I, students may also choose to write an interdisciplinary thesis.
### Module title
Thesis in Physics Secondary General School

### Abbreviation
11-L-HA-MS-DF-152-m01

### Module coordinator
Chairperson of examination committee

### Module offered by
Faculty of Physics and Astronomy

### ECTS
10

### Method of grading
Numerical grade

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

### Duration
Module level

### Other prerequisites
Undergraduate

### Contents
Independent processing of a topic of Physics and/or Didactics of Physics, chosen in consultation with a lecturer.

### Intended learning outcomes
The students are able to independently work on a predetermined physical topic while applying the knowledge and methods acquired in the teaching degree programme. They are able to present their results in written form in due consideration of didactic aspects.

### Courses
No courses assigned to module

### Method of assessment
Hausarbeit (thesis) pursuant to Section 29 LPO I (examination regulations for teaching-degree programmes) (approx. 40 pages)
Language of assessment: German; exceptions pursuant to Section 29 Subsection 4 LPO I (examination regulations for teaching-degree programmes)

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

§ 29