Subdivided Module Catalogue
for the Subject

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

Examination regulations version: 2017
Responsible: Faculty of Mathematics and Computer Science
Responsible: Institute of Computer Science
Course of Studies - Contents and Objectives

The bachelor of science in computer science combining theoretical and practical elements is the first degree level offered by the Department of Mathematics and Computer Science at the Maximilian University of Würzburg.

The aim of this degree is to teach students the most important aspects of computer science, to understand the theory of algorithms and their application as well as to improve analytical skills, the ability to think in abstract terms and structure complex problems. With this degree the students have the skills to either continue their studies in a consecutive Master of Science program or be able to apply their knowledge in one of the many fields of computer science present outside academia. This is complemented by a specialization field in which the students become familiar with the basic techniques and ways of thinking in a subject of their choice for which methods of computer science are used.

The bachelor program focuses on well established and fundamental knowledge of facts and methods as well as on the development of thought processes necessary for computer science. Furthermore, state-of-the-art methods and their relevant applications are taught. With the bachelor thesis, students demonstrate their ability to work on a specific task and use the scientific methods learned within a defined period of time. Though guided by a mentor, they largely carry out the selected project on their own. The bachelor is an internationally acknowledged degree in the field of computer science that demonstrates the ability to work in this field or continue on to obtain a higher degree.
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:

ASPO2015

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

09-Aug-2017 (2017-54)

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

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<tr>
<th>Abbreviation</th>
<th>Module title</th>
<th>ECTS credits</th>
<th>Method of grading</th>
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<tbody>
<tr>
<td>10-I-GdP-172-m01</td>
<td>Fundamentals of Programming</td>
<td>5</td>
<td>NUM</td>
<td>34</td>
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<tr>
<td>10-I-ADS-152-m01</td>
<td>Algorithms and data structures</td>
<td>10</td>
<td>NUM</td>
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<tr>
<td>10-I-ST-152-m01</td>
<td>Software Technology</td>
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<td>10-I-PP-152-m01</td>
<td>Practical Course in Programming</td>
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<td>10-I-SWP-152-m01</td>
<td>Practical course in software</td>
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<tr>
<td>10-I-RAL-152-m01</td>
<td>Digital computer systems</td>
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<td>10-I-IÜ-152-m01</td>
<td>Information Transmission</td>
<td>10</td>
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<td>10-I-HWP-152-m01</td>
<td>Practical course in hardware</td>
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<tr>
<td>10-I-TIV-152-m01</td>
<td>Theoretical Informatics</td>
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<tr>
<td>10-I-TIT-172-m01</td>
<td>Tutorial Theoretical Informatics</td>
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<tr>
<td>10-I-LOG-152-m01</td>
<td>Logic for informatics</td>
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<td>10-M-INF1-152-m01</td>
<td>Mathematics 1 for students in Computer Science</td>
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<td>Mathematics 2 for students in Computer Science</td>
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<tr>
<td>10-I-AGT-152-m01</td>
<td>Algorithmic Graph Theory</td>
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<td>NUM</td>
<td>9</td>
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<tr>
<td>10-I=ICG-152-m01</td>
<td>Interactive Computer Graphics</td>
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<td>NUM</td>
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<tr>
<td>10-I-DB-152-m01</td>
<td>Data Bases</td>
<td>5</td>
<td>NUM</td>
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<td>10-I-WBS-152-m01</td>
<td>Knowledge-based Systems</td>
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<td>Data Mining</td>
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<td>10-I-KT-152-m01</td>
<td>Computational Complexity</td>
<td>5</td>
<td>NUM</td>
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<tr>
<td>10-I-KD-152-m01</td>
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<td>5</td>
<td>NUM</td>
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<td>10-I-3D-152-m01</td>
<td>3D Point Cloud Processing</td>
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<td>NUM</td>
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<tr>
<td>10-I-BS-152-m01</td>
<td>Operating Systems</td>
<td>5</td>
<td>NUM</td>
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<td>10-I-RAK-152-m01</td>
<td>Computer Architecture</td>
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<td>NUM</td>
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<td>10-I-RK-152-m01</td>
<td>Computer Networks and Communication Systems</td>
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<td>NUM</td>
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<tr>
<td>10-I-Gi-152-m01</td>
<td>Selected Basics of Computer Science</td>
<td>5</td>
<td>NUM</td>
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</tbody>
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Compulsory Courses (115 ECTS credits)

Computer Science (75 ECTS credits)

Mathematics (30 ECTS credits)

Compulsory Electives (35 ECTS credits)

Computer Science (25 ECTS credits)

subsidary subject (10 ECTS credits)

Students must select one of the minors offered and must achieve the required number of ECTS credits in this minor.

Mathematics (0 or 10 ECTS credits)

Physics (0 or 10 ECTS credits)
### Bachelor’s with 1 major, 180 ECTS credits

#### Computer Science

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<thead>
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<th>Course Code</th>
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<th>ECTS</th>
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<tbody>
<tr>
<td>11-EFNF-152-m01</td>
<td>Introduction to Physics for Students of other Disciplines</td>
<td>7</td>
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<tr>
<td>11-PFNF-152-m01</td>
<td>Laboratory Course Physics for Students of other Disciplines</td>
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#### Economics (0 or 10 ECTS credits)

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<tr>
<td>12-NW-EBWL-152-m01</td>
<td>Introduction to Business Administration -Minor</td>
<td>5</td>
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<tr>
<td>12-NW-EVWL-152-m01</td>
<td>Introduction to Economics - Minor</td>
<td>5</td>
<td>NUM</td>
</tr>
<tr>
<td>12-ExtUR-G-152-m01</td>
<td>Financial Accounting</td>
<td>5</td>
<td>NUM</td>
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<tr>
<td>12-IntUR-G-152-m01</td>
<td>Managerial Accounting</td>
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<tr>
<td>12-BPL-G-152-m01</td>
<td>Supply, Production and Operations Management. An Introduction</td>
<td>5</td>
<td>NUM</td>
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<tr>
<td>12-I&amp;F-G-152-m01</td>
<td>Investment and Finance. An Introduction</td>
<td>5</td>
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<tr>
<td>12-EwiInf-G-152-m01</td>
<td>Introduction to Business Informatics</td>
<td>5</td>
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<tr>
<td>12-GP-G-152-m01</td>
<td>Integrated Business Processes</td>
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<td>12-FRBE-F-152-m01</td>
<td>Forward and Reverse Business Engineering</td>
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#### Linguistics (0 or 10 ECTS credits)

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<tr>
<td>04-DtLABA-BM-SW-152-m01</td>
<td>Level One Module German Linguistics</td>
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<tr>
<td>04-DtLABA-AM-SW1-152-m01</td>
<td>Level Two Module Grammatical Structures of German</td>
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#### Biology (0 or 10 ECTS credits)

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<tr>
<td>07-1A1TI-152-m01</td>
<td>Evolution and the Animal Kingdom</td>
<td>5</td>
<td>NUM</td>
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<tr>
<td>07-2A2GENV-152-m01</td>
<td>Genetics, Neurobiology, Behaviour</td>
<td>5</td>
<td>NUM</td>
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<tr>
<td>07-M-BST-152-m01</td>
<td>Mathematical Biology and Biostatistics</td>
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<td>07-3A3OEKO-152-m01</td>
<td>Plant and Animal Ecology</td>
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<tr>
<td>07-3A3GEMT-152-m01</td>
<td>Genes, Molecules, Technologies</td>
<td>6</td>
<td>NUM</td>
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#### Law (0 or 10 ECTS credits)

<table>
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<td>02-J1-171-m01</td>
<td>Introduction to the German Legal System</td>
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<tr>
<td>02-G&amp;Hre-G-161-m01</td>
<td>Commercial and Business Law for Economists</td>
<td>5</td>
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#### Geography (0 or 10 ECTS credits)

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<tr>
<td>04-Geo-FER-NE-152-m01</td>
<td>Introduction to Geographical Remote Sensing</td>
<td>5</td>
<td>NUM</td>
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<tr>
<td>04-Geo-FER-NA-152-m01</td>
<td>Applications of Remote Sensing in Geography</td>
<td>5</td>
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#### Medicine (0 or 10 ECTS credits)

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<tr>
<td>03-M-MT-152-m01</td>
<td>Practical Course in medical terminology</td>
<td>5</td>
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<td>03-M-IM-152-m01</td>
<td>Internal Medicine</td>
<td>5</td>
<td>NUM</td>
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#### Key Skills Area (20 ECTS credits)

##### General Key Skills (5 ECTS credits)

In addition to the modules listed below, students may also take modules offered by JMU as part of the pool of general transferable skills (ASQ).

##### General Key Skills (subject-specific)

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<tr>
<td>10-I-TUT1-152-m01</td>
<td>Tutor activity 1</td>
<td>2</td>
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<tr>
<td>10-I-TUT2-152-m01</td>
<td>Tutor activity 2</td>
<td>2</td>
<td>B/NB</td>
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<tr>
<td>10-I-TUT3-152-m01</td>
<td>Tutor activity 3</td>
<td>2</td>
<td>B/NB</td>
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</table>

##### Subject-specific Key Skills (15 ECTS credits)

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<th>Credits</th>
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<tbody>
<tr>
<td>10-I-SEM1-152-m01</td>
<td>Seminar 1</td>
<td>5</td>
<td>NUM</td>
</tr>
<tr>
<td>10-I-SEM2-152-m01</td>
<td>Seminar 2</td>
<td>5</td>
<td>NUM</td>
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<tr>
<td>10-I-PV-152-m01</td>
<td>Project Presentation</td>
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### Thesis (10 ECTS credits)

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<tbody>
<tr>
<td>10-I-BA-152-m01</td>
<td>Bachelor’s Thesis Informatics</td>
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### Module title

3D Point Cloud Processing

### Abbreviation

10-I-3D-152-m01

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
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<tbody>
<tr>
<td>holder of the Chair of Computer Science VII</td>
<td>Institute of Computer Science</td>
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<table>
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<th>ECTS</th>
<th>Method of grading</th>
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<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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### Contents

Laser scanning, Kinect and camera models, basic data structures (lists, arrays, octrees), calculating normals, k-d trees, registration, features, segmentation, tracking, applications for airborne mapping, applications to mobile mapping.

### Intended learning outcomes

Students understand the fundamental principles of all aspects of 3D point cloud processing and are able to communicate with engineers / surveyors / CV people / etc. Students are able to solve problems of modern sensor data processing and have experienced that real application scenarios are challenging in terms of computational requirements, in terms of memory requirements and in terms of implementation issues.

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

V (2) + Ü (2)

### Method of assessment (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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

### 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. 3b
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Algorithms and data structures</td>
<td>10-I-ADS-152-m01</td>
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<table>
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<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
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<tbody>
<tr>
<td>Dean of Studies Informatik (Computer Science)</td>
<td>Institute of Computer Science</td>
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<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Design and analysis of algorithms, recursion vs. iteration, sort and search methods, data structures, abstract data types, lists, trees, graphs, basic graph algorithms, programming in Java.

**Intended learning outcomes**

Students are proficient in independently designing, precisely describing and analyzing algorithms. The students know the basic paradigms for the design of algorithms and can implement them in practical programs. Students are able to estimate the runtime behavior of algorithms and prove the correctness of algorithms.

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

V (4) + Ü (2)

**Method of assessment** (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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). creditable for bonus

**Allocation of places**

--

**Additional information**

--

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

§ 49 I Nr. 1a

§ 69 I Nr. 1a
Module title | Algorithmic Graph Theory  
---|---  
Abbreviation | 10-I-AGT-152-m01  
Module coordinator | holder of the Chair of Computer Science I  
Module offered by | Institute of Computer Science  
ECTS | 5  
Method of grading | numerical grade  
Duration | 1 semester  
Module level | undergraduate  
Other prerequisites | --  
Contents  
We discuss typical graph problems: We solve round trip problems, calculate maximal flows, find matchings and colourings, work with planar graphs and find out how the ranking algorithm of Google works. Using the examples of graph problems, we also become familiar with new concepts, for example how we model problems as linear programs or how we show that they are fixed parameter computable.  
Intended learning outcomes  
The students are able to model typical problems in computer science as graph problems. In addition, the participants are able to decide which tool from the course helps solve a given graph problem algorithmically. In this course, students learn in detail how to estimate the run time of given graph algorithms.  
Courses (type, number of weekly contact hours, language — if other than German)  
V (2) + Ü (2)  
Method of assessment (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. 60 to 120 minutes).  
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).  
Language of assessment: German and/or English  
Allocation of places  
--  
Additional information  
--  
Refereed to in LPO I (examination regulations for teaching-degree programmes)  
§ 22 II Nr. 3b
Applications of Remote Sensing in Geography

Module title | Abbreviation
---|---
Applications of Remote Sensing in Geography | 04-Geo-FERNA-152-m01

Module coordinator | Module offered by
---|---
holder of the Professorship of Remote Sensing | Institute of Geography and Geology

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

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

Contents

The lecture imparts basic knowledge about the analysis of remote sensing data for geographical questions. First, fundamental understanding of remotely sensed data as geoinformation and later geoinformation in general (geographical data, metadata, spatial overlaying of geodata, geographical information systems) is given. Following topics are analogue, visual image interpretation, digital image processing (calibration, transformation, filter) and atmospheric correction. A focus lies on the digital remote sensing based mapping, i.e. spectral analysis, classification and change detection. Furthermore, basics in modelling of remote sensing parameters is conveyed.

Intended learning outcomes

The students explain applications of earth observation and remote sensing. They explain geographical data and reflect their essential characteristics. They summarise fundamental aspects of (digital) image processing and assess different methodological approaches for the evaluation of remote sensing data for geographical questions.

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

V (2) + T (2)
Module taught in: German and/or English

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

written examination (approx. 45 minutes)
Language of assessment: German and/or English
creditable for bonus

Allocation of places

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Additional information

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

--
Module title | Level Two Module Grammatical Structures of German
---|---
Abbreviation | 04-DtLABA-AM-SW1-152-m01

Module coordinator | holder of the Chair of German Linguistics
Module offered by | Institute of German Studies

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

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

Contents
Within the lecture, this module aims to provide an overview of the German syntax with focus on the valency grammatical sentence analysis, e.g. determining clauses by the use of grammatical samples, determining valency depending and non-depending clauses, syntactical function and semantics of relative clauses, formal description of the structure of complex sentences. During this module, which is a part of the seminar, students will practise the analytical and description methods, covered during the lecture, by authentic sentences. This module will start with the analysis of simple sentences, then goes over to levels of clauses and will continue with the analysis of difficult sentences up to sub-levels. The tutorial, which is a part of the module, provides further practise and students will be confident with the covered description and analytical methods.

Intended learning outcomes
Students possess solid knowledge of the sub-area syntax with focus on valency grammar, they are able to identify and determine syntactic structures and are acquainted with the description and analysis of linguistic units up to the sentence level assuredly.

Courses (type, number of weekly contact hours, language — if other than German)
V (1) + S (2) + T (1)

Method of assessment (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. 75 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)
§ 43 I Nr. 2 b)
§ 63 I Nr. 2 b)
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**Contents**

Selected topics in computer science.

**Intended learning outcomes**

The students are able to understand solutions to fundamental problems in computer science and to transfer them to related topics.

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

V (4) + Ü (2)

**Method of assessment** (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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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

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**Contents**

Researching and writing on a defined problem within a given time frame and adhering to the principles of good scientific practice.

**Intended learning outcomes**

The students are able to research and write on a defined problem, adhering to the principles of good scientific practice.

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

No courses assigned to module

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

Bachelor’s thesis (approx. 50 to 100 pages)
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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### Module One Module German Linguistics

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### Contents

Within the lecture, this module aims to provide an overview and first introduction to the important parts of German linguistics. At the same time, the seminar that is a part of the module, provides students with analytical and description methods up to the word level, for example morphological segmentation and classification of individual word forms into basic morphemes, morphology and inflectional morphemes, morphological and semantic analysis of word formation structures, phonetic and phonological transcription in International Phonetic Alphabet (IPA)-phonetics, graphical realisation of phonemes and associated with orthography principles. The associated tutorial helps to practise further and to become more confident with the analytical and description methods, acquired in the seminar.

### Intended learning outcomes

Students possess an overview of the discipline German linguistics and its individual subdisciplines. They are able to describe and analyse linguistic units up to the word level assuredly. Thanks to the module, students are familiar with the basic analytical and description techniques of linguistics, which will be extended and consolidated in the following modules.

### Courses

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

V (2) + S (2) + T (1)

### Method of assessment

(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. 75 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)

§ 43 I Nr. 2 b)
§ 63 I Nr. 2 b)
**Module title**  
Supply, Production and Operations Management. An Introduction

**Abbreviation**  
12-BPL-G-152-m01

**Module coordinator**  
Holder of the Chair of Business Management and Industrial Management

**Module offered by**  
Faculty of Business Management and Economics

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</table>

**Contents**

This course will provide students with an overview of fundamental processes in procurement, production and logistics and the related corporate functions as well as a model-based introduction to related planning procedures.

**Intended learning outcomes**

The students will be able to describe and discuss the objectives and major processes in the domains of corporate procurement, production and logistics as well as their interdependencies. Furthermore, they are capable of developing and applying basic planning models in these fields.

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

V (2) + T (2)

**Method of assessment** (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. 60 minutes)

**Allocation of places**

620 places. (1) No restrictions with regard to available places for Bachelor’s students of Wirtschaftswissenschaft (Business Management and Economics) (BSc with 180 ECTS credits), Wirtschaftsmathematik (Mathematics for Economics) (BSc with 180 ECTS credits), Wirtschaftsinformatik (Business Information Systems) (BSc with 180 ECTS credits) as well as Bachelor’s students with the minor Wirtschaftswissenschaft (Business Management and Economics) (60 ECTS credits). (2) The remaining places will be allocated to students of other subjects. (3) When places are allocated in accordance with (2) and the number of applications exceeds the number of available places, places will be allocated according to the following quotas: a) Quota 1 (50 % of places): total number of ECTS credits already achieved in the respective degree subject; among applicants with the same number of ECTS credits achieved, places will be allocated by lot. b) Quota 2 (25 % of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. c) Quota 3 (25 % of places): lottery. (4) A waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**

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

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<td>Institute of Computer Science</td>
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**Contents**

Introduction to computer systems, development of operating systems, architecture principles, interrupt processing in operating systems, processes and threads, CPU scheduling, synchronisation and communication, memory management, device and file management, operating system virtualisation.

**Intended learning outcomes**

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

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

V (2) + Ü (2)

**Method of assessment** (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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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

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**Contents**

Foundations in the following areas: definition of data mining and knowledge, discovery in databases, process model, relationship to data warehouse and OLAP, data preprocessing, data visualisation, unsupervised learning methods (cluster and association methods), supervised learning (e.g. Bayes classification, KNN, decision trees, SVM), learning methods for special data types, other learning paradigms.

**Intended learning outcomes**

The students possess a theoretical and practical knowledge of typical methods and algorithms in the area of data mining and machine learning. They are able to solve practical knowledge discovery problems with the help of the knowledge acquired in this course and by using the KDD process. They have acquired experience in the use or implementation of data mining algorithms.

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

V (2) + Ü (2)

**Method of assessment** (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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English

creditable for bonus

**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. 3b
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<td>Data Bases</td>
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</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** (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)

**Method of assessment** (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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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

§ 49 I Nr. 1b
§ 69 I Nr. 1b
Introduction to Business Administration -Minor

12-NW-EBWL-152-m01

Module title

Abbreviation

Introduction to Business Administration -Minor

12-NW-EBWL-152-m01

Module coordinator

Holder of the Chair of Corporate Finance

Module offered by

Faculty of Business Management and Economics

ECTS

5

Method of grading

numerical grade

Only after succ. compl. of module(s)

Duration

1 semester

Module level

undergraduate

Other prerequisites

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Contents

This course aims to provide non-specialist students with an overview of the structure and the ways of thinking of modern business administration. In this context, we will also apply selected conventional tools for the description and solution of problems in selected areas of the subject.

Outline of syllabus

1. What is business?
2. Business and its view of human beings
3. Optimal decisions in business administration
4. Cooperation benefits
5. Coordination of conventional markets
6. Market failure
7. Coordination in companies
8. Stakeholder value vs. shareholder value
9. Financial implementation of shareholder value
10. Legal forms

Intended learning outcomes

After completing the module, students should be able to describe the modern business economics as a scientific discipline in its institutional economic expression and to master appropriate level in their problem-solving techniques used on the character of an orientation session.

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

V (2) + Ü (2)

Method of assessment (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. 60 minutes)

Allocation of places

200 places (lottery)

Additional information

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

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### Introduction to Discrete Mathematics for students of other subjects

**Module title**

Introduction to Discrete Mathematics for students of other subjects

**Abbreviation**

10-M-DIMaf-152-m01

**Module coordinator**

Dean of Studies Mathematik (Mathematics)

**Module offered by**

Institute of Mathematics

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**Duration**

1 semester

**Module level**

undergraduate

**Other prerequisites**

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### Contents

Techniques from combinatorics, introduction to graph theory (including applications), cryptographic methods, error-correcting codes.

### Intended learning outcomes

The student is acquainted with the fundamental concepts and results in discrete mathematics, masters the relevant proof techniques, is able to apply methods from number theory and algebra to discrete mathematics and realises the scope of applications of discrete structures.

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

V (4) + Ü (2)

### Method of assessment (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 to 180 minutes, usually chosen) or b) oral examination of one candidate each (15 to 30 minutes) or c) oral examination in groups (groups of 2, 10 to 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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<td>holder of the Professorship of Remote Sensing</td>
<td>Institute of Geography and Geology</td>
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**Contents**

The lecture gives an overview of the principles of remote sensing, that are: theoretical basics, history of remote sensing / physical principles (energy and radiation, interactions radiation - atmosphere, interactions radiation - surfaces, objects under investigation: soils, vegetation, water) / thermal remote sensing: radiation laws, radiant temperature, emissivity / detectors: characterisation of remote sensing data, platforms and sensors (passive and active systems, e.g. hyperspectral and LiDAR) / radar remote sensing / radar interferometry / basics for remote sensing parameters (land, atmosphere, oceans).

**Intended learning outcomes**

The students describe basics of earth observation. They outline and explain the radiation path through the atmosphere to the object under investigation and back to the sensor. They emphasise essential characteristics of remote sensing data, sensors and platforms.

**Courses**

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

V (2) + T (2)

Module taught in: German and/or English

**Method of assessment**

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

written examination (approx. 45 minutes)

Language of assessment: German and/or English

creditable for bonus

**Allocation of places**

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**Additional information**

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

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<td>Introduction to Physics for Students of other Disciplines</td>
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<td>Managing Director of the Institute of Applied Physics</td>
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### Contents
Mechanics, vibration theory, thermodynamics, optics, science of electricity, Atomic and Nuclear Physics.

### Intended learning outcomes
The students have knowledge of the principles of Physics.

### Courses (type, number of weekly contact hours, language — if other than German)
V (4) + V (3)

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
written examination (60 to 120 minutes)

### Allocation of places
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### Additional information
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### Referred to in LPO I (examination regulations for teaching-degree programmes)
--
**Module title**  
Introduction to the German Legal System

**Abbreviation**  
02-J1-171-m01

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

**Module offered by**  
Faculty of Law

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**Duration**  
1 semester  
undergraduate

**Module level**  
undergraduate

**Other prerequisites**  
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**Contents**

German contents available but not translated yet.


**Intended learning outcomes**

German intended learning outcomes available but not translated yet.


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

V (4)

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

written examination (approx. 120 minutes)

**Allocation of places**

max. 80 places. 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 with a restricted number of places will be allocated in the same procedure.

**Additional information**

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

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<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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</thead>
<tbody>
<tr>
<td>Introduction to Economics - Minor</td>
<td>12-NW-EVWL-152-m01</td>
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<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
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<tbody>
<tr>
<td>Holder of the Chair of Monetary Policy and International Economics</td>
<td>Faculty of Business Management and Economics</td>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

The course offers basic insights into the principles of economics. We analyse how markets work, i.e., how consumers form their demand and how suppliers make production decisions. On the basis of first insights into market economies, we analyse why governments might want to intervene. In this context, we focus on monopoly, environmental issues and minimum wages in labour markets.

In addition to micro topics, we also focus on macroeconomic aspects and analyse why we observe business cycles (unemployment, inflation) and long term economic growth. We also address topics related to monetary and fiscal policy in the euro area.

**Intended learning outcomes**

The students have a basic knowledge of economics, with which they can analyze complex economic relationships. They can deal critically with current economic policy issues and make an independent judgment. In addition, elementary mathematical techniques for solving microeconomic and macroeconomic models are mediated.

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

V (2) + Ü (2)

**Method of assessment** (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. 60 minutes)

**Allocation of places**

max. 200 places. Modules 12-NW-EBWL and 12-NW-EVWL are not open for students of the following subjects: Wirtschaftswissenschaft (Business Management and Economics) Bachelor’s (BSc with 180 ECTS credits), Wirtschaftsinformatik (Business Information Systems) Bachelor’s (BSc with 180 ECTS credits) and Wirtschaftsmathematik (Mathematics for Economics) Bachelor’s (BSc with 180 ECTS credits).

**Additional information**

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

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<td>Introduction to Business Informatics</td>
<td>12-Ewiinf-G-152-m01</td>
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<td>Holder of the Chair of Business Management and Business Information Systems</td>
<td>Faculty of Business Management and Economics</td>
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</table>

## Contents

**Content:**

This course offers an introduction to the essential aspects of business information systems.

**Outline of syllabus:**

1. Integration of IT systems
2. From data processing to information processing
3. eCommerce and eGovernment
4. Functionality of IT technology
5. Application development principles
6. Intercommunication

**Reading:**

Thome: Grundzüge der Wirtschaftsinformatik.

## Intended learning outcomes

The course "Einführung in die Wirtschaftsinformatik" communicates

(i) an overview of the different task fields of the business informations systems discipline;

(ii) an understanding for recent developments in the discipline and related technologies.

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

V (2) + T (2)

## Method of assessment (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) written examination consisting entirely or partly of multiple choice questions (approx. 60 minutes)

Language of assessment: German and/or English creditable for bonus

## Allocation of places

840 places. (1) No restrictions with regard to available places for Bachelor’s students of Wirtschaftswissenschaft (Business Management and Economics) (BSc with 180 ECTS credits), Wirtschaftsmathematik (Mathematics for Economics) (BSc with 180 ECTS credits), Wirtschaftsinformatik (Business Information Systems) (BSc with 180 ECTS credits) as well as Bachelor’s students with the minor Wirtschaftswissenschaft (Business Management and Economics) (60 ECTS credits). (2) Additional places will be allocated to students of other subjects. (3) When places are allocated in accordance with (2) and the number of applications exceeds the number of available places, places will be allocated by lot among all applicants irrespective of their subjects. (4) Places on all courses of the module with a restricted number of places will be allocated in the same procedure. (5) A waiting list will be maintained and places re-allocated by lot as they become available.

## Additional information

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

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<thead>
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<th>Module title</th>
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<td>Introduction Into Number Theory for students of other subjects</td>
<td>10-M-ZTHaf-152-m01</td>
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<td>Dean of Studies Mathematik (Mathematics)</td>
<td>Institute of Mathematics</td>
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</table>

**Contents**

Elementary properties of divisibility, prime numbers and prime number factorisation, modular arithmetics, prime tests and methods for factorisation, structure of the residue class rings, theory of quadratic remainder, quadratic forms, diophantine approximation and diophantine equations.

**Intended learning outcomes**

The student is acquainted with the fundamental concepts and methods of number theory. He/she is able to employ the basic methods and proof techniques independently.

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

V (4) + Ü (2)

**Method of assessment** (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 to 180 minutes, usually chosen) or b) oral examination of one candidate each (15 to 30 minutes) or c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)

Language of assessment: German and/or English creditable for bonus

**Allocation of places**

--

**Additional information**

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

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Subdivided Module Catalogue for the Subject
Computer Science
Bachelor's with 1 major, 180 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tr>
<td>Evolution and the Animal Kingdom</td>
<td>07-1AI1TI-152-m01</td>
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<tr>
<th>Module coordinator</th>
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<tbody>
<tr>
<td>holder of the Professorship of Zoology at the Department of Electronmicroscopy</td>
<td>Faculty of Biology</td>
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<tbody>
<tr>
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<td>undergraduate</td>
<td>Admission prerequisite to assessment: exercises. Regular attendance (minimum 80%) and successful completion of exercises (approx. 25 to 30 hours) are prerequisites for admission to assessment.</td>
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</tbody>
</table>

Contents

The lecture Evolution will acquaint students with fundamental concepts and mechanisms of evolutionary biology: the origins of diversity; natural and sexual selection; speciation; population genetics. It will provide students with an introduction to phylogenetic reconstruction and will thus enable them to develop an understanding of the system of plants and animals. During the exercise, students will complete exercises on mechanistic evolution and evolutionary history. The lecture Tierreich (Animal Kingdom) will discuss the diversity of animal organisms on the basis of the phyla of the animal kingdom focusing on phylogenetic criteria. It will address the ecological constraints that led to the development of different types of body plans with their different structures and functions. In this context, the lecture will also develop an awareness in students of how important a knowledge of the fundamental principles of zoology is for research and applications not only but in particular in biology and medicine. In the exercise, students will prepare and/or examine selected species and histological preparations and will thus become familiar with the functional and morphological characteristics of the major multicellular animal phyla. In this context, students will practise working with light microscopes and stereo microscopes and will acquire fundamental preparation skills. They will prepare drawings, documenting and interpreting what they have seen.

Intended learning outcomes

Students will be familiar with the fundamental concepts and mechanisms of evolutionary biology and will know that these are key to understanding biological processes. They will have gained an overview of the diversity of animals on the basis of different types of body plans and will understand important structures in both a functional and an ecological context.

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

V (2) + Ü (3)

Method of assessment (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. 60 minutes) creditable for bonus

Allocation of places

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Additional information

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

§ 61 I Nr. 1 (4 ECTS credits) and § 61 I Nr. 4 (1 ECTS credits)
§ 41 I Nr. 1 (4 ECTS credits) and § 41 I Nr. 4 (1 ECTS credits)
Module title: Financial Accounting
Abbreviation: 12-ExtUR-G-152-m01

Module coordinator: Holder of the Chair of Business Taxation
Module offered by: Faculty of Business Management and Economics

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

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

Contents:
This course offers an introduction to the fundamentals of financial accounting, including the technique of double-entry book-keeping as well as the fundamentals of recognition, valuation and presentation of assets, liabilities and equity according to German commercial law.

Intended learning outcomes:
Students acquire a basic understanding of the fundamentals of financial accounting. They are able to arrange, reproduce and apply this knowledge, i.e. they are able to solve simple accounting problems.

Courses (type, number of weekly contact hours, language — if other than German):
V (2) + T (2)

Method of assessment (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. 60 minutes)

Allocation of places:
840 places. (1) No restrictions with regard to available places for Bachelor’s students of Wirtschaftswissenschaft (Business Management and Economics) (BSc with 180 ECTS credits), Wirtschaftsmathematik (Mathematics for Economics) (BSc with 180 ECTS credits), Wirtschaftsinformatik (Business Information Systems) (BSc with 180 ECTS credits) as well as Bachelor’s students with the minor Wirtschaftswissenschaft (Business Management and Economics) (60 ECTS credits). (2) The remaining places will be allocated to students of other subjects. (3) When places are allocated in accordance with (2) and the number of applications exceeds the number of available places, places will be allocated according to the following quotas: a) Quota 1 (50 % of places): total number of ECTS credits already achieved in the respective degree subject; among applicants with the same number of ECTS credits achieved, places will be allocated by lot. b) Quota 2 (25 % of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. c) Quota 3 (25 % of places): lottery.

Additional information:
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Referred to in LPO I (examination regulations for teaching-degree programmes):
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### Module title
**Advanced Programming**

**Abbreviation**
10-I-APR-172-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
--

### Contents
With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler programs. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and code a sensible structure. Also, further topics in the areas of software security and parallel programming are discussed.

### Intended learning outcomes
Students learn advanced programming paradigms especially suited for space applications. Different patterns are then implemented in multiple languages and their efficiency measured using standard metrics. In addition, parallel processing concepts are introduced culminating in the use of GPU architectures for extremely quick processing.

### Courses (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)

### Method of assessment (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. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

### Allocation of places
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### Additional information
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### Referred to in LPO I (examination regulations for teaching-degree programmes)
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<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Forward and Reverse Business Engineering</td>
<td>12-FRBE-F-152-m01</td>
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| Holder of the Chair of Business Management and Business Information Systems |

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

**Contents**

"Business Engineering" refers to the method and model-based design theory for companies in the information age. "Forward" refers to design methods (such as situation analysis, requirements analysis and business process modelling) that help implement a new solution. "Reverse" refers to approaches (such as the use and process analysis) that make it possible to improve or re-design existing structures and processes. Market requirements and technological innovation potential are typical reasons for the continuous transformation of a company. The resulting change needs to be implemented into the organisational structure, business processes and information systems.

The course traces the implementation cycle of enterprise software from the point of view of a member of a project team. In addition to acquainting students with the theoretical basis of adaptation, the course will also discuss examples from practical projects.

**Intended learning outcomes**

The students know in detail the process of adaptation of business software libraries. They master the methods of Forward Engineering (such as situation analysis, requirement analysis, process modeling and business blueprint) and Reverse Engineering (Reverse Business Engineering) and their implementation in tools.

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

V (2) + Ü (2)

**Method of assessment** (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) term paper (approx. 15 pages) or c) term paper (approx. 10 to 15 pages) and presentation (approx. 10 minutes), weighted 2:1

creditable for bonus

**Allocation of places**

50 places. Should the number of applications exceed the number of available places, places will be allocated as follows: (1) Bachelor's students of Wirtschaftsinformatik (Business Information Systems) (BSc with 180 ECTS credits) will be given preferential consideration. (2) The remaining places will be allocated to students of other subjects. (3) When places are allocated in accordance with (1) and (2) and the number of applications exceeds the number of available places, places will be allocated by lot among applicants from this group. (4) Places on all courses of the module with a restricted number of places will be allocated in the same procedure. (5) A waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**

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

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Module title: Genes, Molecules, Technologies
Abbreviation: 07-3A3GEMT-152-m01

Module coordinator: Dean of Studies Biologie (Biology)
Module offered by: Faculty of Biology

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

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

Contents
The module Genes, Molecules, Technologies includes lectures on the following topics: The section Spezielle Genetik (Special Genetics) will build on Einführung in die Genetik (Introduction to Genetics) and will deepen the students' knowledge of topics from the following areas: structure and evolution of the eukaryotic genome, regulatory RNA, epigenetically and evolutionarily significant genetic mechanisms. The section will also focus on methods of gene expression profiling, reverse genetics and modern methods of gene function and gene sequence analysis. In the lecture Einführung in die Bioinformatik (Introduction to Bioinformatics), students will acquire an overview of major areas in the field of bioinformatics: protein sequence and protein domain analysis, phylogeny and evolution of sequences, protein structure, RNA/DNA sequences and structures, cellular networks (regulation, metabolism) and systems biology. During the section Einführung in die Biotechnologie (Introduction to Biotechnology), students will acquire an overview of the following topics: history of biotechnology, DNA and RNA technologies, recombinant antibodies, molecular diagnostics, nanobiotechnology, biomaterials, bioprocess engineering, microbial biotechnology, transgenic animals and plants, microfluidics. The lecture Einführung in die Pharmakokinetik (Introduction to Pharmacokinetics) will provide students with an overview of the rational development of drugs and active agents. The module component will discuss an important aspect for biologists in more detail: the optimisation of the pharmacokinetics of small molecules and proteins. Pharmacokinetics describes the uptake, distribution, metabolism and elimination of a drug or xenobiotic in an organism.

Intended learning outcomes
Students possess an advanced knowledge on genome evolution and the regulation of gene expression and are familiar with current methods in genetics as well as methods for the analysis of DNA and protein databases. They have acquired an overview of both traditional and modern methods in biotechnology and are familiar with fundamental topics in biotechnology. Students have acquired an overview of the fundamental principles of the development and review of active agents in research, clinical practice and the pharmaceutical industry. They are familiar with methods and technologies in biology and are able to evaluate potential applications of these in research and industry.

Courses (type, number of weekly contact hours, language — if other than German)
V (4)

Method of assessment (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)
creditable for bonus

Allocation of places
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Additional information
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<table>
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<th>Abbreviation</th>
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<tbody>
<tr>
<td>Genetics, Neurobiology, Behaviour</td>
<td>07-2A2GENV-152-m01</td>
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<tr>
<td>Dean of Studies Biologie (Biology)</td>
<td>Faculty of Biology</td>
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<td>Admission prerequisite to assessment: exercises. Regular attendance (minimum 80%) and successful completion of exercises (approx. 25 to 30 hours) are prerequisites for admission to assessment.</td>
</tr>
</tbody>
</table>

**Contents**

Fundamental principles of genetics, neurobiology and behavioural biology.

**Intended learning outcomes**

Students will understand that there are molecular, cellular and system biological mechanisms and processes involved in animal behaviour and will be able to relate animal behaviour to the molecular and formal bases of inheritance.

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

V (3)

**Method of assessment** (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. 60 to 90 minutes)

creditable for bonus

**Allocation of places**

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**Additional information**

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

§ 61 I Nr. 2 (2 ECTS credits)
§ 61 I Nr. 3 (1 ECTS credits)
§ 61 I Nr. 4 (1 ECTS credits)
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<th>Module title</th>
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### Contents

Existence and uniqueness theorem; continuous dependence of solutions on initial values, systems of linear differential equations, matrix exponential series, linear differential equations of higher order.

### Intended learning outcomes

The student is acquainted with the fundamental concepts and methods of the theory of ordinary differential equations. He/she is able to apply these methods to practical problems.

### Courses

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

V (4) + Ü (2)

### Method of assessment

(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 to 180 minutes, usually chosen) or b) oral examination of one candidate each (15 to 30 minutes) or c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)

Language of assessment: German and/or English
creditable for bonus

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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<table>
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<td>Fundamentals of Programming</td>
<td>10-I-GdP-172-m01</td>
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<tbody>
<tr>
<td>holder of the Chair of Computer Science II</td>
<td>Institute of Computer Science</td>
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</table>

**Contents**

Data types, control structures, foundations of procedural programming, selected topics of C, introduction to object orientation in Java, selected topics of C++, further Java concepts, digression: scripting languages.

**Intended learning outcomes**

The students possess a fundamental knowledge about programming languages (in particular Java, C and C++) and are able to independently develop average to high level Java programs.

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

V (2) + Ü (2)

**Method of assessment** (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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

creditable for bonus

**Allocation of places**

--

**Additional information**

--

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

--
Module title | Abbreviation
---|---
Investment and Finance. An Introduction | 12-I&F-G-152-m01

Module coordinator | Module offered by
Holder of the Chair of Corporate Finance | Faculty of Business Management and Economics

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<td>1 semester</td>
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Contents
This module provides an overview of neoclassical investment and financing theory. The students will be familiarized with the basics of finance, including both tax aspects and risk considerations.

Structure:
Part 1: Investment calculation
a. Financial Mathematics: calculation of compound interest and annuities
b. Investments under certainty
c. Investments taking into account taxes
d. Investments under uncertainty

Part 2: Financing
a. Forms of financing
b. Capital structure policy (equity versus debt financing)
c. Dividend policy (external versus internal financing)

Intended learning outcomes
After completing the course „Investments and Finance: An Introduction“, the students will be able to
(i) understand the fundamentals in financial mathematics;
(ii) solve investments decisions by means of dynamic approaches, in particular via capital plans and present values;
(iii) systematize forms of financing and evaluate their application.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + T (2)

Method of assessment (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. 60 minutes)

Allocation of places
620 places. (1) No restrictions with regard to available places for Bachelor’s students of Wirtschaftswissenschaft (Business Management and Economics) (BSc with 180 ECTS credits), Wirtschaftsmathematik (Mathematics for Economics) (BSc with 180 ECTS credits), Wirtschaftsinformatik (Business Information Systems) (BSc with 180 ECTS credits) as well as Bachelor’s students with the minor Wirtschaftswissenschaft (Business Management and Economics) (60 ECTS credits). (2) The remaining places will be allocated to students of other subjects. (3) When places are allocated in accordance with (2) and the number of applications exceeds the number of available places, places will be allocated according to the following quotas: a) Quota 1 (50 % of places): total number of ECTS credits already achieved in the respective degree subject; among applicants with the same number of ECTS credits achieved, places will be allocated by lot. b) Quota 2 (25 % of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. c) Quota 3 (25 % of places): lottery. (4) A waiting list will be maintained and places re-allocated by lot as they become available.

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

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<table>
<thead>
<tr>
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<td>Commercial and Business Law for Economists</td>
<td>02-G&amp;Hre-G-161-m01</td>
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<td>Dean of the Faculty of Law</td>
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### Contents

German contents available but not translated yet.

Dieses Modul bietet eine Einführung in das deutsche und europäische Gesellschafts- und Handelsrecht.

### 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 (3) + Ü (2)

### Method of assessment (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: Usually once a year, summer semester

### Allocation of places

There are no restrictions with regard to available places for students of Rechtswissenschaft (Law) as well as Bachelor’s students with the minor Privatrecht (Private Law). A total of 20 places will be allocated to students of other subjects. 10 of these will be allocated to students of the Master’s degree programme Economics. Should the number of available places exceed the number of applications, the remaining places may be allocated to students of other subjects. Should there be more than 10 applications, the remaining places will be allocated as follows: Students applying after not having successfully completed assessment in past years will be given preferential consideration. The remaining places will be allocated by lot. A waiting list will be maintained and places reallocated by lot as they become available.

### Additional information

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

--
Module title: Practical course in hardware
Abbreviation: 10-I-HWP-152-m01

Module coordinator: Dean of Studies Informatik (Computer Science)
Module offered by: Institute of Computer Science

ECTS: 10
Method of grading: Only after successfully completed module(s)
Duration: 1 semester
Module level: undergraduate
Other prerequisites: --

Contents
Practical experiments on hardware aspects, for example in communication technology, robots or the structure of a complete microprocessor.

Intended learning outcomes
The students are able to independently review, prepare and perform experiments with the help of experiment descriptions, to independently search for additional information as well as to document and evaluate experiment results.

Courses (type, number of weekly contact hours, language — if other than German)
P (6)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
portfolio: completion of approx. 3 to 10 project assignments (approx. 250 hours total) and presentation of results (approx. 10 minutes per project)

Allocation of places
--

Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 22 II Nr. 3b
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<td>Information Transmission</td>
<td>10-I-IÜ-152-m01</td>
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<td>Institute of Computer Science</td>
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</table>

**Contents**

Introduction to probability calculus, coding theory, coding for fault detection and fault correction, information theory, spectrum and Fourier transform, modulation technique, structure of digital transmission systems, introduction to the structure of computer networks, communication protocols.

**Intended learning outcomes**

The students possess a technical, theoretical and practical knowledge of the structure of systems for information transmission, a knowledge that is necessary to understand these systems.

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

V (4) + Ü (2)

**Method of assessment** (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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

creditable for bonus

**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. 3b
### Module title
- **Internal Medicine**

### Abbreviation
- 03-M-IM-152-m01

### Module coordinator
- unknown

### Module offered by
- Faculty of Medicine

### ECTS
- 5

### Method of grading
- numerical grade

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

### Duration
- 1 semester

### Module level
- unknown

### Other prerequisites
- --

### Contents
- No information on contents available.

### Intended learning outcomes
- No information on intended learning outcomes available.

### Courses (type, number of weekly contact hours, language — if other than German)
- V (0)

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
- oral examination (one candidate each: approx. 15 minutes, or groups of up to 3 candidates: approx. 10 minutes per candidate)

Assessment will usually have reference to one of the sub-specialities of internal medicine, e.g. cardiology, pulmonology, nephrology, endocrinology, oncology, gastroenterology, rheumatology, infectious disease.

### Allocation of places
- --

### Additional information
- --

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

### Abbreviation
12-GP-G-152-m01

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<td>Faculty of Business Management and Economics</td>
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### Contents
This course is aimed at students of Wirtschaftsinformatik (Business Information Systems) and Wirtschaftswissenschaft (Business Management and Economics) interested in the topic. The course is divided up into two parts. In the theoretical part, students will acquire the necessary theoretical knowledge that will serve as a basis for the practical part. The practical exercise will present students with an opportunity to apply their newly acquired knowledge by working with an SAP S4/HANA on case studies on the model company Almika. In this context, the human resources, purchasing, sales, service, project management and finance departments will be dealt with.

The course will introduce students to business processes of an ERP system (Enterprise Resource Planning) using the example of SAP S/4HANA. In addition to the basic principles, students will also become familiar with the processes and functionalities.

### Intended learning outcomes
After completing the course, the students will be able to
1. reflect technical principles and operational models of ERP systems,
2. understand the functionality of ERP systems and
3. perform and understand business processes within the ERP system SAP Business ByDesign.

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

V (2) + Ü (2)

### Method of assessment
(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) term paper (approx. 15 pages) or c) term paper (approx. 10 to 15 pages) and presentation (approx. 10 minutes), weighted 2:1 creditable for bonus

### Allocation of places

15 places. (1) The number of places is not restricted for students of the Bachelor’s degree subject Wirtschaftsinformatik (Business Information Systems) (BSc with 180 ECTS credits). (2) Additional places will be allocated to students of other subjects provided there is enough capacity. These additional places will be allocated by lot among all applicants irrespective of their subjects. (3) Places on all courses of the module with a restricted number of places will be allocated in the same procedure. (4) A waiting list will be maintained and places re-allocated by lot as they become available.

### Additional information
--

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

**Abbreviation**  
10-I=ICG-152-m01

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

**Module offered by**  
Institute of Computer Science

**ECTS**  
5

**Method of grading**  
numeralic grade

**Duration**  
1 semester

**Module level**  
graduate

**Other prerequisites**  
--

**Contents**

Computer graphics studies methods for digitally synthesising and manipulating visual content. This course specifically concentrates on interactive graphics with an additional focus on 3D graphics as a requirement for many contemporary as well as for novel human-computer interfaces and computer games. The course will cover topics about light and images, lighting models, data representations, mathematical formulations of movements, projection as well as texturing methods. Theoretical aspects of the steps involved in ray-tracing and the raster pipeline will be complemented by algorithmical approaches for interactive image syntheses using computer systems. Accompanying software solutions will utilise modern graphics packages and languages like OpenGL, GLSL and/or DirectX.

**Intended learning outcomes**

At the end of the course, the students will have a broad understanding of the underlying theoretical models of computer graphics. They will be able to implement a prominent variety of these models, to build their own interactive graphics applications and to choose the right software tool for this task.

**Courses**

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

V (2) + Ü (2)

**Method of assessment**

(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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English

creditable for bonus

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits):

HCI

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

--
Module title: Managerial Accounting  
Abbreviation: 12-IntUR-G-152-m01

Module coordinator: Holder of the Chair of Financial Accounting  
Module offered by: Faculty of Business Management and Economics

ECTS: 5  
Method of grading: Only after succ. compl. of module(s)  
Duration: 1 semester  
Module level: undergraduate  
Other prerequisites: --

Contents

Content:
This course offers an introduction to aims and methods of managerial accounting (cost accounting).  
Outline of syllabus:
1. Managerial accounting and financial accounting  
2. Managerial accounting: basic terms  
3. Different types of costs  
4. Cost centre accounting based on total costs  
5. Job costing based on total costs  
6. Cost centre accounting and job costing based on direct/variable costs  
7. Budgeting and cost-variance analysis  
8. Cost-volume-profit analysis  
9. Cost information and operating decisions

Reading:
Friedl/Hofmann/Pedell: Kostenrechnung. Eine entscheidungsorientierte Einführung. (most recent editions)

Intended learning outcomes

After completing the course "Management Accounting and Control", the students will be able to
(i) set out the responsibilities of the company's internal accounting and control;
(ii) define the central concepts of internal enterprise computing restriction and control and assign case studies
the terms;
(iii) apply the basic methods of internal corporate accounting and control on a full and cost base to idealized ca-
se studies of medium difficulty that calculate relevant costs and benefits and take on this basis a reasoned deci-

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

V (2) + T (2)

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

written examination (approx. 60 minutes)

Allocation of places

840 places. (1) No restrictions with regard to available places for Bachelor's students of Wirtschaftswissenschaft
(Business Management and Economics) (BSc with 180 ECTS credits), Wirtschaftsmathematik (Mathematics for
Economics) (BSc with 180 ECTS credits), Wirtschaftsinformatik (Business Information Systems) (BSc with 180
ECTS credits) as well as Bachelor's students with the minor Wirtschaftswissenschaft (Business Management and
Economics) (60 ECTS credits). (2) The remaining places will be allocated to students of other subjects. (3) When
places are allocated in accordance with (2) and the number of applications exceeds the number of available pla-
ces, places will be allocated according to the following quotas: a) Quota 1 (50 % of places): total number of ECTS
credits already achieved in the respective degree subject; among applicants with the same number of ECTS cre-
dits achieved, places will be allocated by lot. b) Quota 2 (25 % of places): number of subject semesters of the re-
spective applicant; among applicants with the same number of subject semesters, places will be allocated by
lot. c) Quota 3 (25 % of places): lottery. (4) A waiting list will be maintained and places re-allocated by lot as they
become available.
### Additional information

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**Module title**  
Computational Complexity

**Abbreviation**  
10-I-KT-152-m01

**Module coordinator**  
Dean of Studies Informatik (Computer Science)

**Module offered by**  
Institute of Computer Science

**ECTS**  
5

**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**

Complexity measurements and classes, general relationships between space and time classes, memory consumption versus computation time, determinism versus indeterminism, hierarchical theorems, translation methods, P-NP problem, completeness problems, Turing reduction, interactive proof systems.

**Intended learning outcomes**

The students possess a fundamental and applicable knowledge in the areas of complexity measurements and classes, general relationships between space and time classes, memory consumption versus computation time, determinism versus indeterminism, hierarchical theorems, translation methods, P-NP problem, completeness problems, Turing reduction, interactive proof systems.

**Courses**

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

V (2) + Ü (2)

**Method of assessment**

(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. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

**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. 3b
### Module: Cryptography and Data Security

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<td>Cryptography and Data Security</td>
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**Module coordinator**
Dean of Studies Informatik (Computer Science)

**Module offered by**
Institute of Computer Science

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#### Contents

- Private key cryptography systems, Vernam one-time pad, AES, perfect security, public key cryptography systems, RSA, Diffie-Hellman, Elgamal, Goldwasser-Micali, digital signature, challenge-response methods, secret sharing, millionaire problem, secure circuit evaluation, homomorphous encryption.

#### Intended learning outcomes

The students possess a fundamental and applicable knowledge in the areas of private key cryptography systems, Vernam one-time pad, AES, perfect security, public key cryptography, RSA, Diffie-Hellman, Elgamal, Goldwasser-Micali, digital signature, challenge-response method, secret sharing, millionaire problem, secure circuit evaluation, homomorphous encryption.

#### Courses

- **V (2) + Ü (2)**

#### Method of assessment

- written examination (approx. 60 to 120 minutes).
- If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
- Language of assessment: German and/or English creditable for bonus

#### Allocation of places

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#### Additional information

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#### Referred to in LPO I

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<td>Dean of Studies Informatik (Computer Science)</td>
<td>Institute of Computer Science</td>
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### Contents

Syntax and semantics of propositional logic, equivalence and normal forms, Horn formulas, SAT, resolution, infinite formula sets, syntax and semantics of predicate logic.

### Intended learning outcomes

The students are proficient in the following areas: syntax and semantics of propositional logic, equivalence and normal forms, Horn formulas, SAT, resolution, infinite formula sets, syntax and semantics of predicate logic.

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

V (2) + Ü (2)

### Method of assessment (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. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

### Allocation of places

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### Additional information

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

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**Contents**

Propositional logic, set theory, proof techniques, relations; sequences, limits and lambda-symbols; the ring of integers; elementary group theory; residue class rings; basics in linear algebra, linear maps and matrix calculus, systems of linear equations.

**Intended learning outcomes**

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

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

V (4) + Ü (2)

Module taught in: Ü: German or English

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

a) written examination (approx. 90 to 180 minutes, usually chosen) or b) oral examination of one candidate each (15 to 30 minutes) or c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)

Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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

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<td>Mathematics 2 for students in Computer Science</td>
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**Contents**

Determinants, eigenvalue theory; event and probability spaces, combinatorics, random variables, examples of distributions, parameter estimates; basics in analysis.

**Intended learning outcomes**

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

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

V (4) + Ü (2)

Module taught in: Ü: German or English

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

a) written examination (approx. 90 to 180 minutes, usually chosen) or b) oral examination of one candidate each (15 to 30 minutes) or c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)

Language of assessment: German and/or English

creditable for bonus

**Allocation of places**

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**Additional information**

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

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**Contents**

Fundamental principles of the most important mathematical and statistical methods in biology.

**Intended learning outcomes**

Students will have acquired fundamental skills in the evaluation of experiments, the interpretation of readings and numbers as well as the mathematical description of biological processes.

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

V (2) + Ü (2)

**Method of assessment** (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. 60 minutes) creditable for bonus

**Allocation of places**  --

**Additional information**  --

**Referred to in LPO I** (examination regulations for teaching-degree programmes)  --
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**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 (4) + Ü (2)

**Method of assessment** (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 to 180 minutes, usually chosen) or b) oral examination of one candidate each (15 to 30 minutes) or c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)

Language of assessment: German and/or English
creditable for bonus

**Allocation of places**

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**Additional information**

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

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### Module title
Plant and Animal Ecology

### Abbreviation
07-3A3OEKO-152-m01

### Module coordinator
Dean of Studies Biologie (Biology)

### Module offered by
Faculty of Biology

### 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
This module will provide students with an overview of the interactions of plants and animals with their abiotic and biotic environments. The module will focus on the functional adaptation to environmental conditions as well as on the structure and dynamics of populations, communities and ecosystems. Students will be introduced to fundamental model concepts of ecology, will become familiar with examples of research findings and will acquire the fundamental knowledge necessary to develop an understanding of current ecological problems.

### Intended learning outcomes
Students are familiar with the fundamental principles of research in the field of ecology and with the most important abiotic and biotic factors that influence the distribution and frequency of occurrence of organisms in their environment. In addition, they understand the scientific relevance ecology has to the assessment of environmental issues.

### Courses (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)

### Method of assessment (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)
creditable for bonus

### Allocation of places
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### Additional information
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### Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 61 I Nr. 4
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**Contents**
Linear programming, duality theory, transport problems, integral linear programming, graph theoretic problems.

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

**Courses** (type, number of weekly contact hours, language — if other than German)
V (4) + Ü (2)

**Method of assessment** (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 to 180 minutes, usually chosen) or b) oral examination of one candidate each (15 to 30 minutes) or c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)
Assessment offered: In the semester in which the course is offered and in the subsequent semester
Language of assessment: German and/or English creditable for bonus

**Allocation of places**
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**Additional information**
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**Referred to in LPO I** (examination regulations for teaching-degree programmes)
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</table>

**Contents**

Simple experiments in the fields of mechanics, vibration theory, thermodynamics, optics, X-rays, nuclear magnetic resonance, Atomic and Nuclear Physics, imaging methods.

**Intended learning outcomes**

The students have detected and understood physical contexts on the basis of the implementation of own experiments. They have a basic understanding of physical phenomena and know the basic ideas and ways of functioning of different measuring and imaging methods as well as their applications, especially in the field of Biomedicine.

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

P (4)

**Method of assessment** (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) practical assignment with oral test (approx. 15 minutes, during experiments) and b) written examination (90 minutes).

Each experiment comprises preparation, performance and evaluation. Test as well as performance of experiments can each be repeated once.

**Allocation of places**

Only as part of pool of general transferable skills (ASQ): 10 places (lottery)

**Additional information**

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

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**Contents**
No information on contents available.

**Intended learning outcomes**
No information on intended learning outcomes available.

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

P (0)

**Method of assessment** (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. 60 to 90 minutes)

**Allocation of places**
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**Additional information**
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**Contents**
The programming language Java. Independent creation of small to middle-sized, high-quality Java programs.

**Intended learning outcomes**
The students are able to independently develop small to middle-sized, high-quality Java programs.

**Courses** (type, number of weekly contact hours, language — if other than German)
P (6)

**Method of assessment** (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. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

**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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§ 69 I Nr. 1d
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**Contents**

Presentation of a project developed by the student (e.g. Bachelor's thesis, software project) analogous to a presentation for laypersons with a knowledge of computer science at a trade fair. The project, which may also be work-in-progress, is presented with the help of a poster, a short talk and optionally a live demonstration.

**Intended learning outcomes**

The students are able to present a project they developed and to create the required media.

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

| S | 5 |

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

Presentation of a project developed by the candidate analogous to a presentation for laypersons with a knowledge of computer science at a trade fair as well as discussion (approx. 10 to 15 minutes total)

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. 3b
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**Contents**

Introduction to digital technologies, Boolean algebras, combinatorial circuits, synchronous and asynchronous circuits, hardware description languages, structure of a simple processor, machine programming, memory hierarchy.

**Intended learning outcomes**

The students possess a knowledge of the fundamentals of digital technologies up to the design and programming of easy microprocessors as well as knowledge for the application of hardware description languages for the design of digital systems.

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

V (4) + Ü (2)

**Method of assessment** (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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

**Allocation of places**

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**Additional information**

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**Contents**

Instruction set architectures, command processing through pipelining, statiscal 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 (2) + Ü (2)

**Method of assessment** (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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English

creditable for bonus

**Allocation of places**

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**Additional information**

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

§ 69 I Nr. 1c: Rechnerarchitektur
§ 22 II Nr. 3b
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**Contents**


**Intended learning outcomes**

The students possess an intricate knowledge of the structure of computer networks and communication systems as well as fundamental principles to rate these systems.

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

V (4) + Ü (2)

**Method of assessment** (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. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

**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. 3b
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### Contents
Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

### Intended learning outcomes
The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

### 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 can be chosen to earn a bonus)

- written elaboration (approx. 10 to 15 pages) and presentation (approx. 30 to 45 minutes) with subsequent discussion on a topic from the field of computer science
- 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. 3b
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<td>Seminar 2</td>
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**Contents**

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**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 can be chosen to earn a bonus)

Wrap-up report on tutoring activities (5 to 10 pages)
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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Module title
Practical course in software
Abbreviation
10-I-SWP-152-m01

Module coordinator
Dean of Studies Informatik (Computer Science)
Module offered by
Institute of Computer Science

ECTS
10

Method of grading
Only after succ. compl. of module(s)
(not) successfully completed
10-I-PP, 10-I-ST

Duration
1 semester
Module level
undergraduate
Other prerequisites
In addition, the knowledge and skills acquired in module 10-I-ADS are required. Prior attendance of this module is therefore highly recommended.

Contents
Completion of a project assignment in groups, problem analysis, creation of requirements specifications, specification of solution components (e.g., UML) and milestones, user manual, programming documentation, presentation and delivery of the runnable software product in a colloquium.

Intended learning outcomes
The students possess the practical skills for the design, development and execution of a software project in small teams.

Courses (type, number of weekly contact hours, language — if other than German)
P (6)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
practical project (Completion of a larger software project in groups (approx. 300 hours per person) and final presentation (approx. 10 minutes per group)

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 69 I Nr. 1d
## Module title
Software Technology

### Abbreviation
10-I-ST-152-m01

### Module coordinator
Dean of Studies Informatik (Computer Science)

### Module offered by
Institute of Computer Science

### ECTS
10

### Method of grading
Numerical grade

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

### Duration
1 semester

### Module level
Undergraduate

### Other prerequisites
- -

## Contents
Object-oriented software development with UML, development of graphical user interfaces, foundations of databases and object-relational mapping, foundations of web programming (HTML, XML), software development processes, unified process, agile software development, project management, quality assurance.

## Intended learning outcomes
The students possess a fundamental theoretical and practical knowledge on the design and development of software systems.

## Courses
**V** (4) + **Ü** (2)

## Method of assessment
Written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Creditable for bonus

## Allocation of places
- -

## Additional information
- -

## Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 49 I Nr. 1b
§ 69 I Nr. 1b
### Module title

**Stochastics 1 for students of other subjects**

### Abbreviation

10-M-STO-1af-152-m01

### Module coordinator

Dean of Studies Mathematik (Mathematics)

### Module offered by

Institute of Mathematics

### ECTS

10

### Method of grading

Numerical grade

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

--

### Duration

1 semester

### Module level

Undergraduate

### Other prerequisites

--

### Contents

Combinatorics, Laplace models, selected discrete distributions, elementary measure and integration theory, continuous distributions: normal distribution, random variable, distribution function, product measures and stochastic independence, elementary conditional probability, characteristics of distributions: expected value and variance, limit theorems: law of large numbers, central limit theorem.

### Intended learning outcomes

The student is acquainted with fundamental concepts and methods in stochastics, applies these methods to practical problems and knows about the typical fields of application.

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

V (4) + Ü (2)

### Method of assessment (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 to 180 minutes, usually chosen) or b) oral examination of one candidate each (15 to 30 minutes) or c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)

Language of assessment: German and/or English
creditable for bonus

### Allocation of places

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### Additional information

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

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**Contents**

- Computability, decidability, countability, finite automata, regular sets, generative grammars, context-free languages, context-sensitive languages, complexity of calculations, P-NP problem, NP completeness.

**Intended learning outcomes**

The students possess a fundamental and applicable knowledge in the areas of computability, decidability, countability, finite automata, regular sets, generative grammars, context-free languages, context-sensitive languages, complexity of computations, P-NP problem, NP completeness.

**Courses**

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

| V (4) |

**Method of assessment**

(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. 60 to 120 minutes).
  - If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

**Allocation of places**

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**Additional information**

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

- § 49 I Nr. 1a
- § 69 I Nr. 1a
Module title | Abbreviation
---|---
Tutor activity 1 | 10-I-TUT1-152-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)
---|---|---
2 | (not) successfully completed | --

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

Contents
Tutoring activities in the area of computer science.

Intended learning outcomes
Imparting knowledge and skills to students of computer science.

Courses (type, number of weekly contact hours, language — if other than German)
T (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
Wrap-up report on tutoring activities (5 to 10 pages)

Allocation of places
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Additional information
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**Contents**

Tutoring activities in the area of computer science.

**Intended learning outcomes**

Imparting knowledge and skills to students of computer science.

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

| T (2) |

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

Wrap-up report on tutoring activities (5 to 10 pages)

**Allocation of places**

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**Additional information**

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

§ 22 II Nr. 2 f)
§ 22 II Nr. 3 f)
### Module title
Tutor activity 3

### Abbreviation
10-I-TUT3-152-m01

### Module coordinator
Dean of Studies Informatik (Computer Science)

### Module offered by
Institute of Computer Science

### ECTS
2

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

### Duration
undergraduate

### Other prerequisites
--

## Contents
Tutoring activities in the area of computer science.

## Intended learning outcomes
Imparting knowledge and skills to students of computer science.

## Courses (type, number of weekly contact hours, language — if other than German)
- **T**: (2)

## Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
Wrap-up report on tutoring activities (5 to 10 pages)

## Allocation of places
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## Additional information
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**Contents**

Computability, decidability, countability, finite automata, regular sets, generative grammars, context-free languages, context-sensitive languages, complexity of calculations, P-NP problem, NP completeness.

**Intended learning outcomes**

The students possess a fundamental and applicable knowledge in the areas of computability, decidability, countability, finite automata, regular sets, generative grammars, context-free languages, context-sensitive languages, complexity of computations, P-NP problem, NP completeness.

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

| Ü (2) |

**Method of assessment** (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) exercises (consisting in completion of approx. 11 home work exercise sheets, presentation of own solutions in the exercise groups as well as approx. 5 short assessments written in the exercise group) or b) Written examination (approx. 180 to 240 minutes)

Die Prüfungsart ist vom Prüfling festzulegen

**Allocation of places**

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**Additional information**

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**Contents**

Foundations in the following areas: knowledge management systems, knowledge representation, solving methods, knowledge acquisition, learning, guidance dialogue, semantic web.

**Intended learning outcomes**

The students possess theoretical and practical knowledge for the understanding and design of knowledge-based systems including knowledge formalisation and have acquired experience in a small project.

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

V (2) + Ü (2)

**Method of assessment** (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. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

**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. 3b