Module Catalogue
for the Module studies (Master)
Computer Science

Examination regulations version: 2019
Responsible: Institute of Computer Science
## Contents

The subject is divided into

Abbreviations used, Conventions, Notes, In accordance with

### Summer Term 2019

- 3D Point Cloud Processing
- Advanced Automation
- Computational Geometry
- Approximation Algorithms
- Selected Topics in Algorithms
- Selected Topics in Embedded Systems
- Selected Topics in Computer Science
- Selected Topics in HCI
- Selected Topics in Internet Technologies
- Selected Topics in IT Security
- Selected Topics in Aerospace Engineering
- Selected Topics in Theory
- Selected Topics of Games Engineering
- Selected Topics in Software Engineering
- Performance Evaluation of Distributed Systems
- Machine learning for Natural Language Processing
- Performance Engineering and Benchmarking
- Practical course - Current Topics in Computer Science
- Seminar 1 - Current Topics in Computer Science
- Seminar 2 - Current Topics in Computer Science
- Security of Software Systems
- Discrete Event Simulation
- Software Architecture

### Winter Term 2019

- Software Architecture
- 3D Point Cloud Processing
- Advanced Automation
- Computational Geometry
- Approximation Algorithms
- Selected Topics in Algorithms
- Selected Topics in Embedded Systems
- Selected Topics in HCI
- Selected Topics in Computer Science
- Selected Topics in Intelligent Systems
- Selected Topics in Internet Technologies
- Selected Topics in IT Security
- Selected Topics in Aerospace Engineering
- Selected Topics in Theory
- Selected Topics of Games Engineering
- Selected Topics in Software Engineering
- Performance Evaluation of Distributed Systems
- Machine learning for Natural Language Processing
- Performance Engineering and Benchmarking
- Practical course - Current Topics in Computer Science
- Seminar 1 - Current Topics in Computer Science
- Seminar 2 - Current Topics in Computer Science
- Security of Software Systems
- Discrete Event Simulation
- Software Architecture

### Summer Term 2020

- Computer Science (2019)

---

*JMU Würzburg • generated 10-Jul-2021 • exam. reg. data record MM[079]\[\[HE\]2019*
Software Architecture 59
3D Point Cloud Processing 60
Advanced Automation 61
Computational Geometry 62
Approximation Algorithms 63
Selected Topics in Algorithms 64
Selected Topics in Embedded Systems 65
Selected Topics in HCI 66
Selected Topics in Computer Science 67
Selected Topics in Intelligent Systems 68
Selected Topics in Internet Technologies 69
Selected Topics in IT Security 70
Selected Topics in Aerospace Engineering 71
Selected Topics in Theory 72
Selected Topics of Games Engineering 73
Selected Topics in Software Engineering 74
Performance Evaluation of Distributed Systems 75
Machine learning for Natural Language Processing 76
Performance Engineering and Benchmarking 77
Practical course - Current Topics in Computer Science 78
Seminar 1 - Current Topics in Computer Science 79
Seminar 2 - Current Topics in Computer Science 80
Security of Software Systems 81
Discrete Event Simulation 82

Winter Term 2020 83
3D Point Cloud Processing 84
Advanced Automation 85
Computational Geometry 86
Approximation Algorithms 87
Selected Topics in Algorithms 88
Selected Topics in Embedded Systems 89
Selected Topics in HCI 90
Selected Topics in Computer Science 91
Selected Topics in Intelligent Systems 92
Selected Topics in Internet Technologies 93
Selected Topics in IT Security 94
Selected Topics in Aerospace Engineering 95
Selected Topics in Theory 96
Selected Topics of Games Engineering 97
Selected Topics in Software Engineering 98
Performance Evaluation of Distributed Systems 99
Machine learning for Natural Language Processing 100
Performance Engineering and Benchmarking 101
Practical course - Current Topics in Computer Science 102
Seminar 1 - Current Topics in Computer Science 103
Seminar 2 - Current Topics in Computer Science 104
Security of Software Systems 105
Discrete Event Simulation 106
Software Architecture 107

Summer Term 2021 108
3D Point Cloud Processing 109
Advanced Automation 110
Computational Geometry 111
Approximation Algorithms 112
Selected Topics in Algorithms 113
Selected Topics in Embedded Systems 114
Selected Topics in HCI 115
Selected Topics in Computer Science 116
Selected Topics in Intelligent Systems 117
Selected Topics in Internet Technologies 118
Selected Topics in IT Security 119
Selected Topics in Aerospace Engineering 120
Selected Topics in Theory 121
Selected Topics of Games Engineering 122
Selected Topics in Software Engineering 123
Performance Evaluation of Distributed Systems 124
Machine learning for Natural Language Processing 125
Performance Engineering and Benchmarking 126
Practical course - Current Topics in Computer Science 127
Seminar 1 - Current Topics in Computer Science 128
Seminar 2 - Current Topics in Computer Science 129
Security of Software Systems 130
Discrete Event Simulation 131
Software Architecture 132

**Winter Term 2021** 133
3D Point Cloud Processing 134
Advanced Automation 135
Computational Geometry 136
Approximation Algorithms 137
Selected Topics in Algorithms 138
Selected Topics in Embedded Systems 139
Selected Topics in HCI 140
Selected Topics in Computer Science 141
Selected Topics in Intelligent Systems 142
Selected Topics in Internet Technologies 143
Selected Topics in IT Security 144
Selected Topics in Aerospace Engineering 145
Selected Topics in Theory 146
Selected Topics of Games Engineering 147
Selected Topics in Software Engineering 148
Performance Evaluation of Distributed Systems 149
Machine learning for Natural Language Processing 150
Performance Engineering and Benchmarking 151
Practical Course - Current Topics in Computer Science 152
Seminar 1 - Current Topics in Computer Science 153
Seminar 2 - Current Topics in Computer Science 154
Security of Software Systems 155
Discrete Event Simulation 156
Software Architecture 157
The subject is divided into

<table>
<thead>
<tr>
<th>section / sub-section</th>
<th>starting page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer Term 2019</td>
<td>0</td>
</tr>
<tr>
<td>Winter Term 2019</td>
<td>0</td>
</tr>
<tr>
<td>Summer Term 2020</td>
<td>0</td>
</tr>
<tr>
<td>Winter Term 2020</td>
<td>0</td>
</tr>
<tr>
<td>Summer Term 2021</td>
<td>0</td>
</tr>
<tr>
<td>Winter Term 2021</td>
<td>0</td>
</tr>
</tbody>
</table>
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:

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

15-May-2019 (2019-36)
27-Jun-2019 (2019-41)
14-Nov-2019 (2019-52)
22-Jan-2020 (2020-13)
06-May-2019 (2020-39)
22-Jul-2020 (2020-57)
17-Dec-2020 (2020-110)
10-Mar-2021 (2021-17)
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.
Summer Term 2019
(0 ECTS credits)
# 3D Point Cloud Processing

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Point Cloud Processing</td>
<td>10-I=3D-161-m01</td>
</tr>
</tbody>
</table>

## Module coordinator

holder of the Chair of Computer Science VII

## Module offered by

Institute of Computer Science

## ECTS

5

## Method of grading

numerical grade

## Duration

1 semester

## Module level

graduate

## Other prerequisites

--

## Contents

Laser scanning, Kinect and camera models, basic data structures (lists, arrays, oct-trees), 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of weekly contact hours</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>2</td>
<td>English</td>
</tr>
<tr>
<td>Ü</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Module taught in: English

## 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).

Separate written examination for Master’s students.

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): IS, LR, HCI.

## Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Automation</td>
<td>10-I=AA-152-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Advanced topics in automation systems as well as instrumentation and control engineering, for example from the field of sensor data processing, actuators, cooperating systems, mission and trajectory planning.

**Intended learning outcomes**

The students have an advanced knowledge of selected topics in automation systems. They are able to implement advanced automation 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 is creditable for bonus)

written examination (approx. 60 to 120 minutes)
creditable for bonus

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computational Geometry</td>
<td>10-I=AG-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

In many areas of computer science -- for example robotics, computer graphics, virtual reality and geographic information systems -- it is necessary to store, analyse, create or manipulate spatial data. This class is about the algorithmic aspects of these tasks: We will acquire techniques that are needed to plan and analyse geometric algorithms and data structures. Every technique will be illustrated with a problem in the practical areas listed above.

**Intended learning outcomes**

The students are able to decide which algorithms or data structures are suitable for the solution of a given geometric problem. The students are able to analyse new problems and to come up with their own efficient solutions based on the concepts and techniques acquired in the lecture.

**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 is creditable for 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**

--

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

--
Module title
Approximation Algorithms

Abbreviation
10-I=APA-161-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

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

Duration
1 semester

Module level
graduate

Other prerequisites
--

Contents
The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming.

Intended learning outcomes
The students are able to analyse easy approximation methods in terms of their quality. They understand fundamental drafting techniques such as greedy, local search and scaling as well as methods based on linear programming and are able to apply these to new problems.

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 is creditable for 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
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Algorithms</td>
<td>10-I=AKA-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

Selected topics in algorithmics and theory.

### Intended learning outcomes

The students understand the basic approach of algorithmic computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

### 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 is creditable for 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

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
### Module title
Selected Topics in Embedded Systems

### Abbreviation
10-I=AKES-161-m01

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

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

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

### Contents
Selected topics in embedded systems.

### Intended learning outcomes
The students possess specialised knowledge in the area of embedded systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

### 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 is creditable for 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): ES.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in HCI</td>
<td>10-I=AKHCI-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in HCI.

**Intended learning outcomes**

The students understand the basic approach of human-computer interaction. They are able to understand the solutions to complex problems in this area and to transfer them to related questions.

**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 is creditable for bonus)

written examination (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)

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Computer Science</td>
<td>10-I=AKII-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in computer science.

**Intended learning outcomes**

The students are able to understand the solutions to complex problems in computer science and to transfer them to related questions.

**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 is creditable for 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**

--

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

--
### Module title

Selected Topics in Intelligent Systems

### Abbreviation

10-l=AKIS-161-m01

### Module coordinator

holder of the Chair of Computer Science VI

### 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

graduate

### Other prerequisites

--

### Contents

Selected topics in intelligent systems.

### Intended learning outcomes

The students possess an advanced knowledge in the area of intelligent systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

### 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 is creditable for 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): IS.

### Referred to in LPO I

(examination regulations for teaching-degree programmes)
Module title

Selected Topics in Internet Technologies

Abbreviation

10-I=AKIT-161-m01

Module coordinator

holder of the Chair of Computer Science III

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

Graduate

Other prerequisites

--

Contents

Selected topics in computer communication, for example design aspects of future internet structures: setup and control structures of the internet, multicast protocols, protocols for multimedia communication, optical networks, control mechanisms for redundant and real-time communication networks, p2p networks, ad-hoc networks, or -- new concepts and technologies in mobile communication: digital modulation, signal propagation, channel coding, modern transmission technologies (adaptive modulation and coding, hybrid ARQ, OFDM, MIMO), mac layer, mobileIP, routing in ad-hoc networks, vertical handover, UMTS IP multimedia subsystem, or -- planning and management methods in telecommunication networks: planning methods (forward engineering, reverse engineering), network management paradigms (central and decentral), framework for network management (IETF traffic engineering, ITU-T TMN, OSI management), planning and management methods (IP management mechanisms, network design, measurement, acquisition and evaluation of traffic and performance data, visualisation, result handling, simulation and analysis of networks), management tools, outlook and perspectives, or -- other current topics.

Intended learning outcomes

The students have a knowledge of advanced and current topics in the management and design of modern wired and wireless communication 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 is creditable for 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): IT.

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

--
## Module title

**Selected Topics in IT Security**

| Abbreviation | 10-I=AKITS-172-m01 |

## Module coordinator

holder of the Chair of Computer Science II

## Module offered by

Institute of Computer Science

## ECTS

5

## Method of grading

Only after succ. compl. of module(s)

## Numerical grade

--

## Duration

1 semester

## Module level

graduate

## Other prerequisites

--

## Contents

Selected topics in IT security.

## Intended learning outcomes

The students possess an advanced knowledge in the area of IT security. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

## Courses

**Type, number of weekly contact hours, language — if other than German**

V (2) + Ü (2)

Module taught in: English

## Method of assessment

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

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: English

creditable for bonus

## Allocation of places

--

## Additional information

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): SE, IS, LR, HCI, ES.

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

--
Module title | Abbreviation
---|---
Selected Topics in Aerospace Engineering | 10-I=AKLR-161-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science VII | Institute of Computer Science

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

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

Contents
Selected topics in aerospace engineering, for example: satellite communication, rocket science, propulsion systems, sensors and actuators for orientation control, perturbation of orbits, interplanetary orbits, rendezvous and docking, design of space ships, design of planetary bases, life support systems, special aspects of operations, payloads, optical systems, RADAR, earth monitoring, thermo management, structure of space ships, special areas of navigation, space environment, environment simulation, verification and test of space faring systems, space astronomy and planet missions, space medicine and biology, material science, quality management, space law, aeroflight topics, avionics for airplanes, air traffic control, areal navigation, pilot interfaces, air traffic control, air traffic management.

Intended learning outcomes
The students possess an advanced knowledge about the respective topic of the selected area and are able to consider these foundations in their future plans of air or spaceborne 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 is creditable for 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).
Separate written examination for Master’s students.
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): LR.

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Theory</td>
<td>10-I=AKT-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in algorithmics and theory.

**Intended learning outcomes**

The students understand the basic approach of theoretical computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

**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 is creditable for 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**

--

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

--
### Module title
- **Selected Topics of Games Engineering**

### Abbreviation
- 10-I=AGE-191-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

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

### Duration
- 1 semester

### Module level
- graduate

### Other prerequisites
- --

### Contents
- Selected topics in algorithmics and theory.

### Intended learning outcomes
- The students understand the basic approach of games engineering. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

### 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 is creditable for 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): GE.

### Referred to in LPO I
- (examination regulations for teaching-degree programmes)
- --
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Software Engineering</td>
<td>10-I=A</td>
</tr>
</tbody>
</table>

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

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

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

Contents

Selected topics in software engineering.

Intended learning outcomes

The students possess an advanced knowledge about selected aspects of software engineering.

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 is creditable for 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): SE.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Evaluation of Distributed Systems</td>
<td>10-I=LVS-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Traffic theoretic models, fundamental concepts of theory of probability, transformation techniques, stochastic processes, methods for performance analysis of technical systems, queue-/traffic theory, analysis of Markov, non-Markov and time critical systems, matrix analytical method, practical examples for performance analysis of computer systems and networks: throughput and goodput analysis and other characteristics.

**Intended learning outcomes**

The students possess the methodic knowledge and the practical skills necessary to model technical systems by means of the theory of probability and mathematical statistics.

**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 is creditable for 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**

--

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

--
**Module title**

Machine learning for Natural Language Processing

<table>
<thead>
<tr>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-I=NLP-182-m01</td>
</tr>
</tbody>
</table>

**Module coordinator**

Dean of Studies Informatik (Computer Science)

**Module offered by**

Institute of Computer Science

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

**Duration**

1 semester

**Module level**

graduate

**Contents**

The lecture conveys advanced knowledge about methods in computational text processing. To this end, it presents state-of-the-art models and techniques in the area of machine learning, as well as their technical background, and their respective applications in Natural Language Processing. As one important building block of almost all modern NPL-models, different techniques for learning representations of words, so called Word Embeddings, are presented. Starting from this we cover, among others, models from the area of Deep Learning, like CNNs, RNNs and Sequence-to-Sequence architectures. The theoretical foundations of these models, like their training with Backpropagation, are also covered in depth. For all models presented in the lecture, we show their application to problems like sentiment analysis, text generation and machine translation in practice.

**Intended learning outcomes**

The participants have solid knowledge on problems and methods in the area of computational text processing and are able to identify and apply suitable methods for a specific 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 is creditable for 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): AT, IS, HCI.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Engineering and Benchmarking</td>
<td>10-I-PEB-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

Introduction to performance engineering of commercial software systems, performance measurement techniques, benchmarking of commercial software systems, modelling for performance prediction, case studies.

### Intended learning outcomes

The students possess a fundamental and applicable knowledge in the areas of performance metrics, measurement techniques, multi-factorial variance analysis, data analysis with R, benchmark approaches, modelling with queue networks, modelling methods, resource demand approximation, petri nets.

### Courses

(V 2) + Ü 2
Module taught in: English

### Method of assessment

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

### Allocation of places

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical course - Current Topics in Computer Science</td>
<td>10-I=PRAK-161-m01</td>
</tr>
</tbody>
</table>

**Module coordinator**

Dean of Studies Informatik (Computer Science)

**Module offered by**

Institute of Computer Science

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>(not) successfully completed</td>
<td>--</td>
</tr>
</tbody>
</table>

**Duration**

1 semester

**Module level**

graduate

**Other prerequisites**

--

**Contents**

Completion of a practical task.

**Intended learning outcomes**

The practical allows participants to work on a problem in computer science in 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 is creditable for bonus)

term paper (5 to 15 pages)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar 1 - Current Topics in Computer Science</td>
<td>10-I=SEM3-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

**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 is creditable for bonus)

Term paper (10 to 15 pages) and presentation (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**

--

**Additional information**

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar 2 - Current Topics in Computer Science</td>
<td>10-I=SEM4-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

**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 is creditable for bonus)

Term paper (10 to 15 pages) and presentation (30 to 45 minutes) with subsequent discussion on the topic of the seminar.

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security of Software Systems</td>
<td>10-I=SSS-172-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

The lecture provides an overview of common software vulnerabilities, state-of-the-art attack techniques on modern computer systems, as well as the measures implemented to protect against these attacks. In the course, the following topics are discussed:

- x86-64 instruction set architecture and assembly language
- Runtime attacks (code injection, code reuse, defenses)
- Web security
- Blockchains and smart contracts
- Side-channel attacks
- Hardware security

**Intended learning outcomes**

Students gain a deep understanding of software security, from hardware and low-level attacks to modern concepts such as blockchains. The lecture prepares for research in the area of security and privacy, while the exercises allow students to gain hands-on experience with attacks and analysis of systems from an attacker’s perspective.

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

V (2) + Ü (2)

Module taught in: English

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

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: English

creditable for bonus

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): SE, IS, LR, HCI, ES.

Basic programming knowledge in C is required.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discrete Event Simulation</td>
<td>10-I=ST-161-m01</td>
</tr>
</tbody>
</table>

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

**Module offered by**
Institute of Computer Science

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

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

**Contents**
Introduction to simulation techniques, statistical groundwork, creation of random numbers and random variables, random sample theory and estimation techniques, statistical analysis of simulation values, inspection of measured data, planning and evaluation of simulation experiments, special random processes, possibilities and limits of model creation and simulation, advanced concepts and techniques, practical execution of simulation projects.

**Intended learning outcomes**
The students possess the methodic knowledge and the practical skills necessary for the stochastic simulation of (technical) systems, the evaluation of results and the correct assessment of the possibilities and limits of simulation methods.

**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 is creditable for 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**
--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th><strong>Module title</strong></th>
<th><strong>Abbreviation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Architecture</td>
<td>10-I=SAR-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Current topics in the area of aerospace.

**Intended learning outcomes**

The students possess a fundamental and applicable knowledge about advanced topics in software engineering with a focus on modern software architectures and fundamental approaches to model-driven software engineering.

**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 is creditable for 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**

--

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

--
Winter Term 2019
(0 ECTS credits)
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Architecture</td>
<td>10-I=SAR-161-m01</td>
</tr>
</tbody>
</table>

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

**Module offered by**
Institute of Computer Science

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

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

**Contents**
Current topics in the area of aerospace.

**Intended learning outcomes**
The students possess a fundamental and applicable knowledge about advanced topics in software engineering with a focus on modern software architectures and fundamental approaches to model-driven software engineering.

**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 is creditable for 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**
--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Point Cloud Processing</td>
<td>10-I=3D-161-m01</td>
</tr>
</tbody>
</table>

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

**Module offered by**
Institute of Computer Science

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

**Duration**
1 semester

**Module level**
graduate

**Other prerequisites**
--

**Contents**
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**
(V (2) + Ü (2))
Module taught in: English

**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).
Separate written examination for Master’s students.
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): IS, LR, HCI.

**Referred to in LPO I**
(examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th><strong>Module title</strong></th>
<th><strong>Abbreviation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Automation</td>
<td>10-I=AA-152-m01</td>
</tr>
</tbody>
</table>

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

**Module offered by**
Institute of Computer Science

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

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

**Contents**
Advanced topics in automation systems as well as instrumentation and control engineering, for example from the field of sensor data processing, actuators, cooperating systems, mission and trajectory planning.

**Intended learning outcomes**
The students have an advanced knowledge of selected topics in automation systems. They are able to implement advanced automation 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 is creditable for bonus)
written examination (approx. 60 to 120 minutes)
creditable for bonus

**Allocation of places**
--

**Additional information**
--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computational Geometry</td>
<td>10-I=AG-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

In many areas of computer science -- for example robotics, computer graphics, virtual reality and geographic information systems -- it is necessary to store, analyse, create or manipulate spatial data. This class is about the algorithmic aspects of these tasks: We will acquire techniques that are needed to plan and analyse geometric algorithms and data structures. Every technique will be illustrated with a problem in the practical areas listed above.

**Intended learning outcomes**

The students are able to decide which algorithms or data structures are suitable for the solution of a given geometric problem. The students are able to analyse new problems and to come up with their own efficient solutions based on the concepts and techniques acquired in the lecture.

**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 is creditable for 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**

--

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

--
Module title | Abbreviation
---|---
Approximation Algorithms | 10-I=APA-161-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science I | Institute of Computer Science

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td>--</td>
</tr>
</tbody>
</table>

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

Contents
The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming.

Intended learning outcomes
The students are able to analyse easy approximation methods in terms of their quality. They understand fundamental drafting techniques such as greedy, local search and scaling as well as methods based on linear programming and are able to apply these to new problems.

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 is creditable for 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
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Algorithms</td>
<td>10-I=AKA-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in algorithmics and theory.

**Intended learning outcomes**

The students understand the basic approach of algorithmic computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

**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 is creditable for 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**

--

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

--
Module title
Selected Topics in Embedded Systems

Abbreviation
10-I=AKES-161-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)
--

Duration
1 semester

Module level
graduate

Other prerequisites
--

Contents
Selected topics in embedded systems.

Intended learning outcomes
The students possess specialised knowledge in the area of embedded systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

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 is creditable for 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): ES.

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in HCI</td>
<td>10-I=AKHCI-182-m01</td>
</tr>
</tbody>
</table>

**Module coordinator**

holder of the Chair of Computer Science IX

**Module offered by**

Institute of Computer Science

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

**Duration**

1 semester

**Module level**

graduate

**Other prerequisites**

--

**Contents**

Selected topics in HCI.

**Intended learning outcomes**

The students understand the basic approach of human-computer interaction. They are able to understand the solutions to complex problems in this area and to transfer them to related questions.

**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 is creditable for bonus)

written examination (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)

--
<table>
<thead>
<tr>
<th><strong>Module title</strong></th>
<th><strong>Abbreviation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Computer Science</td>
<td>10-I=AKII-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in computer science.

**Intended learning outcomes**

The students are able to understand the solutions to complex problems in computer science and to transfer them to related questions.

**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 is creditable for 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**

--

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

--
Module title: Selected Topics in Intelligent Systems

Abbreviation: 10-I=AKIS-161-m01

Module coordinator: holder of the Chair of Computer Science VI

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: graduate

Other prerequisites: --

Contents

Selected topics in intelligent systems.

Intended learning outcomes

The students possess an advanced knowledge in the area of intelligent systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

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 is creditable for 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): IS.

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

--
Module title | Abbreviation
---|---
Selected Topics in Internet Technologies | 10-I=AKIT-161-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science III | Institute of Computer Science

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

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

Contents
Selected topics in computer communication, for example design aspects of future internet structures: setup and control structures of the internet, multicast protocols, protocols for multimedia communication, optical networks, control mechanisms for redundant and real-time communication networks, p2p networks, ad-hoc networks, or -- new concepts and technologies in mobile communication: digital modulation, signal propagation, channel coding, modern transmission technologies (adaptive modulation and coding, hybrid ARQ, OFDM, MIMO), mac layer, mobileIP, routing in ad-hoc networks, vertical handover, UMTS IP multimedia subsystem, or -- planning and management methods in telecommunication networks: planning methods (forward engineering, reverse engineering), network management paradigms (central and decentral), framework for network management (IETF traffic engineering, ITU-T TMN, OSI management), planning and management methods (IP management mechanisms, network design, measurement, acquisition and evaluation of traffic and performance data, visualisation, result handling, simulation and analysis of networks), management tools, outlook and perspectives, or -- other current topics.

Intended learning outcomes
The students have a knowledge of advanced and current topics in the management and design of modern wired and wireless communication 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 is creditable for 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): IT.

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in IT Security</td>
<td>10-I=AKITS-172-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in IT security.

**Intended learning outcomes**

The students possess an advanced knowledge in the area of IT security. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

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

V (2) + Ü (2)
Module taught in: English

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

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: English
creditable for bonus

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): SE, IS, LR, HCI, ES.

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

--
## Selected Topics in Aerospace Engineering

**Module title**  
Selected Topics in Aerospace Engineering

**Abbreviation**  
10-I-ALR-161-m01

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

**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**  
graduate

**Other prerequisites**  
--

## Contents

Selected topics in aerospace engineering, for example: satellite communication, rocket science, propulsion systems, sensors and actuators for orientation control, perturbation of orbits, interplanetary orbits, rendezvous and docking, design of space ships, design of planetary bases, life support systems, special aspects of operations, payloads, optical systems, RADAR, earth monitoring, thermo management, structure of space ships, special areas of navigation, space environment, environment simulation, verification and test of space faring systems, space astronomy and planet missions, space medicine and biology, material science, quality management, space law, aeroflight topics, avionics for airplanes, air traffic control, areal navigation, pilot interfaces, air traffic control, air traffic management.

## Intended learning outcomes

The students possess an advanced knowledge about the respective topic of the selected area and are able to consider these foundations in their future plans of air or spaceborne 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 is creditable for 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).

Separate written examination for Master’s students.

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): LR.

**Referred to in LPO I**  
(examination regulations for teaching-degree programmes)
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Theory</td>
<td>10-I=AKT-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in algorithmics and theory.

**Intended learning outcomes**

The students understand the basic approach of theoretical computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

**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 is creditable for 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**

--

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

--
Module title | Abbreviation
---|---
Selected Topics of Games Engineering | 10-I=AGE-191-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science I | Institute of Computer Science

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

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

Contents
Selected topics in algorithmics and theory.

Intended learning outcomes
The students understand the basic approach of games engineering. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

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 is creditable for 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): GE.

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module Catalogue for the Module studies (Master)
Computer Science

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Software Engineering</td>
<td>10-I=AKSE-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

<table>
<thead>
<tr>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected topics in software engineering.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intended learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The students possess an advanced knowledge about selected aspects of software engineering.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Courses (type, number of weekly contact hours, language — if other than German)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V (2) + Ü (2)</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): SE.</td>
</tr>
</tbody>
</table>

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

---

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Evaluation of Distributed Systems</td>
<td>10-I=LVS-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents
Traffic theoretic models, fundamental concepts of theory of probability, transformation techniques, stochastic processes, methods for performance analysis of technical systems, queue-/traffic theory, analysis of Markov, non-Markov and time critical systems, matrix analytical method, practical examples for performance analysis of computer systems and networks: throughput and goodput analysis and other characteristics.

### Intended learning outcomes
The students possess the methodic knowledge and the practical skills necessary to model technical systems by means of the theory of probability and mathematical statistics.

### 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 is creditable for 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
--

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

Machine learning for Natural Language Processing

Abbreviation

10-I=NLP-182-m01

Module coordinator

Dean of Studies Informatik (Computer Science)

Module offered by

Institute of Computer Science

ECTS

5

Method of grading

Only after succ. compl. of module(s)

numerical grade

--

Duration

1 semester

Module level

graduate

Other prerequisites

--

Contents

The lecture conveys advanced knowledge about methods in computational text processing. To this end, it presents state of the art models and techniques in the area of machine learning, as well as their technical background, and their respective applications in Natural Language Processing. As one important building block of almost all modern NLP-models, different techniques for learning representations of words, so called Word Embeddings, are presented. Starting from this we cover, among others, models from the area of Deep Learning, like CNNs, RNNs and Sequence-to-Sequence architectures. The theoretical foundations of these models, like their training with Backpropagation, are also covered in depth. For all models presented in the lecture, we show their application to problems like sentiment analysis, text generation and machine translation in practice.

Intended learning outcomes

The participants have solid knowledge on problems and methods in the area of computational text processing and are able to identify and apply suitable methods for a specific 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 is creditable for 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): AT, IS, HCI.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Engineering and Benchmarking</td>
<td>10-I=PEB-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Introduction to performance engineering of commercial software systems, performance measurement techniques, benchmarking of commercial software systems, modelling for performance prediction, case studies.

**Intended learning outcomes**

The students possess a fundamental and applicable knowledge in the areas of performance metrics, measurement techniques, multi-factorial variance analysis, data analysis with R, benchmark approaches, modelling with queue networks, modelling methods, resource demand approximation, petri nets.

**Courses**

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

V (2) + Ü (2)

Module taught in: English

**Method of assessment**

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

written examination (approx. 90 to 120 minutes)

Language of assessment: English

creditable for bonus

**Allocation of places**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical course - Current Topics in Computer Science</td>
<td>10-I=PRAK-161-m01</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>(not) successfully completed</td>
<td>--</td>
</tr>
</tbody>
</table>

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

**Contents**

Completion of a practical task.

**Intended learning outcomes**

The practical allows participants to work on a problem in computer science in 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 is creditable for bonus)

term paper (5 to 15 pages)
Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCl.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar 1 - Current Topics in Computer Science</td>
<td>10-I=SEM3-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

**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 is creditable for bonus)

term paper (10 to 15 pages) and presentation (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**

--

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar 2 - Current Topics in Computer Science</td>
<td>10-I=SEM4-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

**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 is creditable for bonus)

Term paper (10 to 15 pages) and presentation (30 to 45 minutes) with subsequent discussion on the topic of the seminar.

Language of assessment: German and/or English.

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

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

--
Module title | Security of Software Systems
Abbreviation | 10-I=SSS-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
Duration | 1 semester
Module level | graduate
Other prerequisites | --

Contents
The lecture provides an overview of common software vulnerabilities, state-of-the-art attack techniques on modern computer systems, as well as the measures implemented to protect against these attacks. In the course, the following topics are discussed:
- x86-64 instruction set architecture and assembly language
- Runtime attacks (code injection, code reuse, defenses)
- Web security
- Blockchains and smart contracts
- Side-channel attacks
- Hardware security

Intended learning outcomes
Students gain a deep understanding of software security, from hardware and low-level attacks to modern concepts such as blockchains. The lecture prepares for research in the area of security and privacy, while the exercises allow students to gain hands-on experience with attacks and analysis of systems from an attacker’s perspective.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)
Module taught in: English

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

Allocation of places
--

Additional information
Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): SE, IS, LR, HCI, ES.
Basic programming knowledge in C is required.

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th><strong>Module title</strong></th>
<th><strong>Abbreviation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Discrete Event Simulation</td>
<td>10-I=ST-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Introduction to simulation techniques, statistical groundwork, creation of random numbers and random variables, random sample theory and estimation techniques, statistical analysis of simulation values, inspection of measured data, planning and evaluation of simulation experiments, special random processes, possibilities and limits of model creation and simulation, advanced concepts and techniques, practical execution of simulation projects.

**Intended learning outcomes**

The students possess the methodic knowledge and the practical skills necessary for the stochastic simulation of (technical) systems, the evaluation of results and the correct assessment of the possibilities and limits of simulation methods.

**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 is creditable for 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**

--

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

--
Summer Term 2020
(0 ECTS credits)
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Architecture</td>
<td>10-I=SAR-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Current topics in the area of aerospace.

**Intended learning outcomes**

The students possess a fundamental and applicable knowledge about advanced topics in software engineering with a focus on modern software architectures and fundamental approaches to model-driven software engineering.

**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 is creditable for 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**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Point Cloud Processing</td>
<td>10-I=3D-161-m01</td>
</tr>
</tbody>
</table>

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

**Module offered by**
Institute of Computer Science

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

**Duration**
1 semester

**Module level**
graduate

**Other prerequisites**
--

**Contents**
Laser scanning, Kinect and camera models, basic data structures (lists, arrays, oct-trees), 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)
Module taught in: English

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

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).
Separate written examination for Master’s students.
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): IS, LR, HCI.

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
Module title | Abbreviation
---|---
Advanced Automation | 10-I=AA-152-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science VII | Institute of Computer Science

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

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

Contents
Advanced topics in automation systems as well as instrumentation and control engineering, for example from the field of sensor data processing, actuators, cooperating systems, mission and trajectory planning.

Intended learning outcomes
The students have an advanced knowledge of selected topics in automation systems. They are able to implement advanced automation 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 is creditable for bonus)
written examination (approx. 60 to 120 minutes)
creditable for bonus

Allocation of places
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module title: Computational Geometry
Abbreviation: 10-I=AG-161-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
Only after succ. compl. of module(s): --

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

Contents:
In many areas of computer science -- for example robotics, computer graphics, virtual reality and geographic information systems -- it is necessary to store, analyse, create or manipulate spatial data. This class is about the algorithmic aspects of these tasks: We will acquire techniques that are needed to plan and analyse geometric algorithms and data structures. Every technique will be illustrated with a problem in the practical areas listed above.

Intended learning outcomes:
The students are able to decide which algorithms or data structures are suitable for the solution of a given geometric problem. The students are able to analyse new problems and to come up with their own efficient solutions based on the concepts and techniques acquired in the lecture.

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 is creditable for 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:
--

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

Approximation Algorithms

Abbreviation

10-I=APA-161-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

Only after succ. compl. of module(s)

Duration

1 semester

Module level

graduate

Other prerequisites

--

Contents

The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming.

Intended learning outcomes

The students are able to analyse easy approximation methods in terms of their quality. They understand fundamental drafting techniques such as greedy, local search and scaling as well as methods based on linear programming and are able to apply these to new problems.

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 is creditable for 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

--

Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
# Selected Topics in Algorithms

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Algorithms</td>
<td>10-I=AKA-161-m01</td>
</tr>
</tbody>
</table>

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

**Module offered by**
Institute of Computer Science

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

**Duration**
1 semester

**Module level**
graduate

**Other prerequisites**
--

## Contents
Selected topics in algorithmics and theory.

## Intended learning outcomes
The students understand the basic approach of algorithmic computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

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

<table>
<thead>
<tr>
<th>V (2) + Ü (2)</th>
</tr>
</thead>
</table>

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

- written examination (approx. 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
--

## Referred to in LPO I
(examination regulations for teaching-degree programmes)
--
Module title | Abbreviation
--- | ---
Selected Topics in Embedded Systems | 10-I=AKES-161-m01

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

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

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

Contents
Selected topics in embedded systems.

Intended learning outcomes
The students possess specialised knowledge in the area of embedded systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

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 is creditable for 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): ES.

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in HCI</td>
<td>10-l=AKHCI-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

Contents

Selected topics in HCI.

Intended learning outcomes

The students understand the basic approach of human-computer interaction. They are able to understand the solutions to complex problems in this area and to transfer them to related questions.

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 is creditable for bonus)

written examination (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)

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Computer Science</td>
<td>10-I=AKII-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

Selected topics in computer science.

### Intended learning outcomes

The students are able to understand the solutions to complex problems in computer science and to transfer them to related questions.

### 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 is creditable for 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

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Intelligent Systems</td>
<td>10-I=A=AKIS-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in intelligent systems.

**Intended learning outcomes**

The students possess an advanced knowledge in the area of intelligent systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

**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 is creditable for 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): IS.

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

--
**Module title**

Selected Topics in Internet Technologies

**Abbreviation**

10-I=AKIT-161-m01

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

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

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

**Contents**

Selected topics in computer communication, for example design aspects of future internet structures: setup and control structures of the internet, multicast protocols, protocols for multimedia communication, optical networks, control mechanisms for redundant and real-time communication networks, p2p networks, ad-hoc networks, or -- new concepts and technologies in mobile communication: digital modulation, signal propagation, channel coding, modern transmission technologies (adaptive modulation and coding, hybrid ARQ, OFDM, MIMO), mac layer, mobileIP, routing in ad-hoc networks, vertical handover, UMTS IP multimedia subsystem, or -- planning and management methods in telecommunication networks: planning methods (forward engineering, reverse engineering), network management paradigms (central and decentral), framework for network management (IETF traffic engineering, ITU-T TMN, OSI management), planning and management methods (IP management mechanisms, network design, measurement, acquisition and evaluation of traffic and performance data, visualisation, result handling, simulation and analysis of networks), management tools, outlook and perspectives, or -- other current topics.

**Intended learning outcomes**

The students have a knowledge of advanced and current topics in the management and design of modern wired and wireless communication 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 is creditable for 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): IT.

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in IT Security</td>
<td>10-I=AKITS-172-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in IT security.

**Intended learning outcomes**

The students possess an advanced knowledge in the area of IT security. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

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

V (2) + Ü (2)

Module taught in: English

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

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: English
creditable for bonus

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): SE, IS, LR, HCI, ES.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Aerospace Engineering</td>
<td>10-I=AKLR-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in aerospace engineering, for example: satellite communication, rocket science, propulsion systems, sensors and actuators for orientation control, perturbation of orbits, interplanetary orbits, rendezvous and docking, design of space ships, design of planetary bases, life support systems, special aspects of operations, payloads, optical systems, RADAR, earth monitoring, thermo management, structure of space ships, special areas of navigation, space environment, environment simulation, verification and test of space faring systems, space astronomy and planet missions, space medicine and biology, material science, quality management, space law, aeroflight topics, avionics for airplanes, air traffic control, areal navigation, pilot interfaces, air traffic control, air traffic management.

**Intended learning outcomes**

The students possess an advanced knowledge about the respective topic of the selected area and are able to consider these foundations in their future plans of air or spaceborne 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 is creditable for 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).

Separate written examination for Master’s students.

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): LR.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Theory</td>
<td>10-I=AKT-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in algorithmics and theory.

**Intended learning outcomes**

The students understand the basic approach of theoretical computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

**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 is creditable for 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**

--

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

--
<table>
<thead>
<tr>
<th><strong>Module title</strong></th>
<th><strong>Abbreviation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics of Games Engineering</td>
<td>10-I=AGE-191-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in algorithmics and theory.

**Intended learning outcomes**

The students understand the basic approach of games engineering. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

**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 is creditable for 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): GE.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Software Engineering</td>
<td>10-I=AKSE-161-m01</td>
</tr>
</tbody>
</table>

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

**Module offered by**  
Institute of Computer Science

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

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

**Contents**  
Selected topics in software engineering.

**Intended learning outcomes**  
The students possess an advanced knowledge about selected aspects of software engineering.

**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 is creditable for 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): SE.

**Referred to in LPO I** (examination regulations for teaching-degree programmes)  
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Evaluation of Distributed Systems</td>
<td>10-I=LVS-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Traffic theoretic models, fundamental concepts of theory of probability, transformation techniques, stochastic processes, methods for performance analysis of technical systems, queue-/traffic theory, analysis of Markov, non-Markov and time critical systems, matrix analytical method, practical examples for performance analysis of computer systems and networks: throughput and goodput analysis and other characteristics.

**Intended learning outcomes**

The students possess the methodic knowledge and the practical skills necessary to model technical systems by means of the theory of probability and mathematical statistics.

**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 is creditable for 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**

--

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

--
Module title: Machine learning for Natural Language Processing

Abbreviation: 10-I=NLP-182-m01

Module coordinator: Dean of Studies Informatik (Computer Science)

Module offered by: Institute of Computer Science

ECTS: 5

Method of grading: numerical grade

Duration: 1 semester

Module level: graduate

Contents:
The lecture conveys advanced knowledge about methods in computational text processing. To this end, it presents state of the art models and techniques in the area of machine learning, as well as their technical background, and their respective applications in Natural Language Processing. As one important building block of almost all modern NLP-models, different techniques for learning representations of words, so called Word Embeddings, are presented. Starting from this we cover, among others, models from the area of Deep Learning, like CNNs, RNNs and Sequence-to-Sequence architectures. The theoretical foundations of these models, like their training with Backpropagation, are also covered in depth. For all models presented in the lecture, we show their application to problems like sentiment analysis, text generation and machine translation in practice.

Intended learning outcomes:
The participants have solid knowledge on problems and methods in the area of computational text processing and are able to identify and apply suitable methods for a specific task.

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:

--

Additional information:

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, IS, HCI.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Engineering and Benchmarking</td>
<td>10-I=PEB-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Introduction to performance engineering of commercial software systems, performance measurement techniques, benchmarking of commercial software systems, modelling for performance prediction, case studies.

**Intended learning outcomes**

The students possess a fundamental and applicable knowledge in the areas of performance metrics, measurement techniques, multi-factorial variance analysis, data analysis with R, benchmark approaches, modelling with queue networks, modelling methods, resource demand approximation, petri nets.

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

V (2) + Ü (2)

Module taught in: English

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

Written examination (approx. 90 to 120 minutes)

Language of assessment: English

Creditable for bonus

**Allocation of places**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical course - Current Topics in Computer Science</td>
<td>10-I=PRAK-161-m01</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>(not) successfully completed</td>
<td>--</td>
</tr>
</tbody>
</table>

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

**Contents**

Completion of a practical task.

**Intended learning outcomes**

The practical allows participants to work on a problem in computer science in 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 is creditable for bonus)

term paper (5 to 15 pages)  
Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar 1 - Current Topics in Computer Science</td>
<td>10-I=SEM3-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

**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 is creditable for bonus)

Term paper (10 to 15 pages) and presentation (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**

--

**Additional information**

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

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

--
### Module title
**Seminar 2 - Current Topics in Computer Science**

### Abbreviation
10-I-SEM4-161-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)
--

### Duration
1 semester

### Module level
Graduate

### Other prerequisites
--

### Contents
Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

### 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
**S** (2)

### Method of assessment
Term paper (10 to 15 pages) and presentation (30 to 45 minutes) with subsequent discussion on the topic of the seminar

Language of assessment: German and/or English

### Allocation of places
--

### Additional information
Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security of Software Systems</td>
<td>10-I=SSS-172-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

The lecture provides an overview of common software vulnerabilities, state-of-the-art attack techniques on modern computer systems, as well as the measures implemented to protect against these attacks. In the course, the following topics are discussed:

- x86-64 instruction set architecture and assembly language
- Runtime attacks (code injection, code reuse, defenses)
- Web security
- Blockchains and smart contracts
- Side-channel attacks
- Hardware security

**Intended learning outcomes**

Students gain a deep understanding of software security, from hardware and low-level attacks to modern concepts such as blockchains. The lecture prepares for research in the area of security and privacy, while the exercises allow students to gain hands-on experience with attacks and analysis of systems from an attacker’s perspective.

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

V (2) + Ü (2)
Module taught in: English

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

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: English creditable for bonus

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): SE, IS, LR, HCI, ES.
Basic programming knowledge in C is required.

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

--
Module title | Abbreviation
---|---
Discrete Event Simulation | 10-I=ST-161-m01

Module coordinator
holder of the Chair of Computer Science III

Module offered by
Institute of Computer Science

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

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

Contents
Introduction to simulation techniques, statistical groundwork, creation of random numbers and random variables, random sample theory and estimation techniques, statistical analysis of simulation values, inspection of measured data, planning and evaluation of simulation experiments, special random processes, possibilities and limits of model creation and simulation, advanced concepts and techniques, practical execution of simulation projects.

Intended learning outcomes
The students possess the methodic knowledge and the practical skills necessary for the stochastic simulation of (technical) systems, the evaluation of results and the correct assessment of the possibilities and limits of simulation methods.

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 is creditable for 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
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Winter Term 2020
(0 ECTS credits)
Module title | Abbreviation
---|---
3D Point Cloud Processing | 10-I=3D-161-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science VII | Institute of Computer Science

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

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

**Contents**

Laser scanning, Kinect and camera models, basic data structures (lists, arrays, oc-trees), 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)

Module taught in: English

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

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).

Separate written examination for Master’s students.

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): IS, LR, HCI.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Automation</td>
<td>10-I=AA-152-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Advanced topics in automation systems as well as instrumentation and control engineering, for example from the field of sensor data processing, actuators, cooperating systems, mission and trajectory planning.

**Intended learning outcomes**

The students have an advanced knowledge of selected topics in automation systems. They are able to implement advanced automation 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 is creditable for bonus)

written examination (approx. 60 to 120 minutes)

creditable for bonus

**Allocation of places**

--

**Additional information**

--

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

--
Module title: Computational Geometry
Abbreviation: 10-I=AG-161-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: graduate
Other prerequisites: --

Contents:
In many areas of computer science -- for example robotics, computer graphics, virtual reality and geographic information systems -- it is necessary to store, analyse, create or manipulate spatial data. This class is about the algorithmic aspects of these tasks: We will acquire techniques that are needed to plan and analyse geometric algorithms and data structures. Every technique will be illustrated with a problem in the practical areas listed above.

Intended learning outcomes:
The students are able to decide which algorithms or data structures are suitable for the solution of a given geometric problem. The students are able to analyse new problems and to come up with their own efficient solutions based on the concepts and techniques acquired in the lecture.

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 is creditable for 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: --

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

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 graduate

Other prerequisites --

Contents
The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming.

Intended learning outcomes
The students are able to analyse easy approximation methods in terms of their quality. They understand fundamental drafting techniques such as greedy, local search and scaling as well as methods based on linear programming and are able to apply these to new problems.

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
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Algorithms</td>
<td>10-I=AKA-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in algorithmics and theory.

**Intended learning outcomes**

The students understand the basic approach of algorithmic computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

**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 is creditable for 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**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Embedded Systems</td>
<td>10-I=AKES-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

Selected topics in embedded systems.

### Intended learning outcomes

The students possess specialised knowledge in the area of embedded systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

### 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 is creditable for 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): ES.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in HCI</td>
<td>10-I-=AKHCl-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

Selected topics in HCI.

### Intended learning outcomes

The students understand the basic approach of human-computer interaction. They are able to understand the solutions to complex problems in this area and to transfer them to related questions.

### 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 is creditable for bonus)

written examination (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 Catalogue for the Module studies (Master)

### Computer Science

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Computer Science</td>
<td>10-I=AKII-182-m01</td>
</tr>
</tbody>
</table>

### Module coordinator

- Dean of Studies Informatik (Computer Science)  
- Institute of Computer Science

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

### Duration

- 1 semester  
- graduate  
- --

### Contents

Selected topics in computer science.

### Intended learning outcomes

The students are able to understand the solutions to complex problems in computer science and to transfer them to related questions.

### 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 is creditable for 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

- --

### Referred to in LPO I

- examination regulations for teaching-degree programmes

---
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Intelligent Systems</td>
<td>10-l=AKIS-161-m01</td>
</tr>
</tbody>
</table>

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

**Module offered by**
Institute of Computer Science

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

**Duration**
1 semester

**Module level**
graduate

**Other prerequisites**
--

**Contents**
Selected topics in intelligent systems.

**Intended learning outcomes**
The students possess an advanced knowledge in the area of intelligent systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

**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 is creditable for 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): IS.

**Referred to in LPO I**
(examination regulations for teaching-degree programmes)
--
**Module title** | **Abbreviation**
---|---
Selected Topics in Internet Technologies | 10-I=AKIT-161-m01

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

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

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

**Contents**

Selected topics in computer communication, for example design aspects of future internet structures: setup and control structures of the internet, multicast protocols, protocols for multimedia communication, optical networks, control mechanisms for redundant and real-time communication networks, p2p networks, ad-hoc networks, or -- new concepts and technologies in mobile communication: digital modulation, signal propagation, channel coding, modern transmission technologies (adaptive modulation and coding, hybrid ARQ, OFDM, MIMO), mac layer, mobileIP, routing in ad-hoc networks, vertical handover, UMTS IP multimedia subsystem, or -- planning and management methods in telecommunication networks: planning methods (forward engineering, reverse engineering), network management paradigms (central and decentral), framework for network management (IETF traffic engineering, ITU-T TMN, OSI management), planning and management methods (IP management mechanisms, network design, measurement, acquisition and evaluation of traffic and performance data, visualisation, result handling, simulation and analysis of networks), management tools, outlook and perspectives, or -- other current topics.

**Intended learning outcomes**

The students have a knowledge of advanced and current topics in the management and design of modern wired and wireless communication 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 is creditable for 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): IT.

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

---
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in IT Security</td>
<td>10-I=AKITS-172-m01</td>
</tr>
</tbody>
</table>

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

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

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

Contents

Selected topics in IT security.

Intended learning outcomes

The students possess an advanced knowledge in the area of IT security. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

Courses

<table>
<thead>
<tr>
<th>(type, number of weekly contact hours, language — if other than German)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V (2) + Ü (2)</td>
</tr>
</tbody>
</table>

Module taught in: English

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: English
creditable for bonus

Allocation of places

--

Additional information

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): SE, JS, LR, HCI, ES.

Referred to in LPO I

(examination regulations for teaching-degree programmes)
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Aerospace Engineering</td>
<td>10-I=AKLR-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

Selected topics in aerospace engineering, for example: satellite communication, rocket science, propulsion systems, sensors and actuators for orientation control, perturbation of orbits, interplanetary orbits, rendezvous and docking, design of space ships, design of planetary bases, life support systems, special aspects of operations, payloads, optical systems, RADAR, earth monitoring, thermo management, structure of space ships, special areas of navigation, space environment, environment simulation, verification and test of space faring systems, space astronomy and planet missions, space medicine and biology, material science, quality management, space law, aeroflight topics, avionics for airplanes, air traffic control, areal navigation, pilot interfaces, air traffic control, air traffic management.

### Intended learning outcomes

The students possess an advanced knowledge about the respective topic of the selected area and are able to consider these foundations in their future plans of air or spaceborne systems.

### Courses

<table>
<thead>
<tr>
<th>(type, number of weekly contact hours, language — if other than German)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V (2) + Ü (2)</td>
</tr>
</tbody>
</table>

### 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).
- Separate written examination for Master’s students.
- 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): LR.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Theory</td>
<td>10-I=AKT-161-m01</td>
</tr>
</tbody>
</table>

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

**Module offered by**
Institute of Computer Science

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

**Duration**
1 semester

**Module level**
graduate

**Other prerequisites**
--

**Contents**
Selected topics in algorithmics and theory.

**Intended learning outcomes**
The students understand the basic approach of theoretical computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

**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 is creditable for 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**
--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics of Games Engineering</td>
<td>10-I-AGE-191-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in algorithmics and theory.

**Intended learning outcomes**

The students understand the basic approach of games engineering. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

**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 is creditable for 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): GE.

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

--
**Module title**
Selected Topics in Software Engineering

**Abbreviation**
10-I=AKSE-161-m01

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

**Module offered by**
Institute of Computer Science

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

**Duration**
1 semester

**Module level**
graduate

**Other prerequisites**
--

### Contents
Selected topics in software engineering.

### Intended learning outcomes
The students possess an advanced knowledge about selected aspects of software engineering.

### 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 is creditable for 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): SE.

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Evaluation of Distributed Systems</td>
<td>10-I=LVS-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

Traffic theoretic models, fundamental concepts of theory of probability, transformation techniques, stochastic processes, methods for performance analysis of technical systems, queue-/traffic theory, analysis of Markov, non-Markov and time critical systems, matrix analytical method, practical examples for performance analysis of computer systems and networks: throughput and goodput analysis and other characteristics.

### Intended learning outcomes

The students possess the methodic knowledge and the practical skills necessary to model technical systems by means of the theory of probability and mathematical statistics.

### 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 is creditable for 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

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
--- | ---
Machine learning for Natural Language Processing | 10-I=NLP-182-m01

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

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

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

Contents
The lecture conveys advanced knowledge about methods in computational text processing. To this end, it presents state of the art models and techniques in the area of machine learning, as well as their technical background, and their respective applications in Natural Language Processing. As one important building block of almost all modern NLP-models, different techniques for learning representations of words, so called Word Embeddings, are presented. Starting from this we cover, among others, models from the area of Deep Learning, like CNNs, RNNs and Sequence-to-Sequence architectures. The theoretical foundations of these models, like their training with Backpropagation, are also covered in depth. For all models presented in the lecture, we show their application to problems like sentiment analysis, text generation and machine translation in practice.

Intended learning outcomes
The participants have solid knowledge on problems and methods in the area of computational text processing and are able to identify and apply suitable methods for a specific 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 is creditable for 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): AT, IS, HCI.

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

### Abbreviation
10-I=PEB-182-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
graduate

### Other prerequisites
--

### Contents
Introduction to performance engineering of commercial software systems, performance measurement techniques, benchmarking of commercial software systems, modelling for performance prediction, case studies.

### Intended learning outcomes
The students possess a fundamental and applicable knowledge in the areas of performance metrics, measurement techniques, multi-factorial variance analysis, data analysis with R, benchmark approaches, modelling with queue networks, modelling methods, resource demand approximation, petri nets.

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

- V (2) + Ü (2)
- Module taught in: English

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

- written examination (approx. 90 to 120 minutes)
- Language of assessment: English
- creditable for bonus

### Allocation of places
--

### Additional information
--

### Referred to in LPO 1 (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical course - Current Topics in Computer Science</td>
<td>10-I=PRAK-161-m01</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>(not) successfully completed</td>
<td>-</td>
</tr>
</tbody>
</table>

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

**Contents**

Completion of a practical task.

**Intended learning outcomes**

The practical allows participants to work on a problem in computer science in 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 is creditable for bonus)

term paper (5 to 15 pages)

Language of assessment: German and/or English

**Allocation of places**

- -

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

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

- -
Module title: Seminar 1 - Current Topics in Computer Science

Abbreviation: 10-I=SEM3-161-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): --

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

Contents:
Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

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:
The module is worth 5 ECTS credits.
Modules type, number of weekly contact hours, language (if other than German):
S (2)

Method of assessment:
The method of assessment is a term paper (10 to 15 pages) and presentation (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:
--

Additional information:
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.
Referred to in LPO (examination regulations for teaching-degree programmes):
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar 2 - Current Topics in Computer Science</td>
<td>10-I=SEM4-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**  
Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

**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 is creditable for bonus)  
Term paper (10 to 15 pages) and presentation (30 to 45 minutes) with subsequent discussion on the topic of the seminar  
Language of assessment: German and/or English

**Allocation of places**  
--

**Additional information**  
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

**Referred to in LPO I** (examination regulations for teaching-degree programmes)  
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security of Software Systems</td>
<td>10-I=SSS-172-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

The lecture provides an overview of common software vulnerabilities, state-of-the-art attack techniques on modern computer systems, as well as the measures implemented to protect against these attacks. In the course, the following topics are discussed:

- x86-64 instruction set architecture and assembly language
- Runtime attacks (code injection, code reuse, defenses)
- Web security
- Blockchains and smart contracts
- Side-channel attacks
- Hardware security

**Intended learning outcomes**

Students gain a deep understanding of software security, from hardware and low-level attacks to modern concepts such as blockchains. The lecture prepares for research in the area of security and privacy, while the exercises allow students to gain hands-on experience with attacks and analysis of systems from an attacker’s perspective.

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

V (2) + Ü (2)

Module taught in: English

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

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: English

Creditable for bonus

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): SE, IS, LR, HCI, ES.

Basic programming knowledge in C is required.

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discrete Event Simulation</td>
<td>10-I=ST-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Introduction to simulation techniques, statistical groundwork, creation of random numbers and random variables, random sample theory and estimation techniques, statistical analysis of simulation values, inspection of measured data, planning and evaluation of simulation experiments, special random processes, possibilities and limits of model creation and simulation, advanced concepts and techniques, practical execution of simulation projects.

**Intended learning outcomes**

The students possess the methodic knowledge and the practical skills necessary for the stochastic simulation of (technical) systems, the evaluation of results and the correct assessment of the possibilities and limits of simulation methods.

**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 is creditable for 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**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Architecture</td>
<td>10-I=SAR-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Current topics in the area of aerospace.

**Intended learning outcomes**

The students possess a fundamental and applicable knowledge about advanced topics in software engineering with a focus on modern software architectures and fundamental approaches to model-driven software engineering.

**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 is creditable for 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**

--

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

--
Summer Term 2021
(o ECTS credits)
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Point Cloud Processing</td>
<td>10-I=3D-161-m01</td>
</tr>
</tbody>
</table>

**Module coordinator**

holder of the Chair of Computer Science VII

**Module offered by**

Institute of Computer Science

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

**Duration**

1 semester

**Module level**

graduate

**Other prerequisites**

--

**Contents**

Laser scanning, Kinect and camera models, basic data structures (lists, arrays, oct-trees), 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)

Module taught in: English

**Method of assessment**

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

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).

Separate written examination for Master’s students.

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): IS, LR, HCI.

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
---|---
Advanced Automation | 10-I=AA-152-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science VII | Institute of Computer Science

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

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

Contents
Advanced topics in automation systems as well as instrumentation and control engineering, for example from the field of sensor data processing, actuators, cooperating systems, mission and trajectory planning.

Intended learning outcomes
The students have an advanced knowledge of selected topics in automation systems. They are able to implement advanced automation 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 is creditable for bonus)
written examination (approx. 60 to 120 minutes)
creditable for bonus

Allocation of places
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module title | Abbreviation
--- | ---
Computational Geometry | 10-I=AG-161-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science I | Institute of Computer Science

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

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

Contents
In many areas of computer science -- for example robotics, computer graphics, virtual reality and geographic information systems -- it is necessary to store, analyse, create or manipulate spatial data. This class is about the algorithmic aspects of these tasks: We will acquire techniques that are needed to plan and analyse geometric algorithms and data structures. Every technique will be illustrated with a problem in the practical areas listed above.

Intended learning outcomes
The students are able to decide which algorithms or data structures are suitable for the solution of a given geometric problem. The students are able to analyse new problems and to come up with their own efficient solutions based on the concepts and techniques acquired in the lecture.

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 is creditable for 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
--

Referred to in LPO I
(examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximation Algorithms</td>
<td>10-I=APA-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming.

**Intended learning outcomes**

The students are able to analyse easy approximation methods in terms of their quality. They understand fundamental drafting techniques such as greedy, local search and scaling as well as methods based on linear programming and are able to apply these to new problems.

**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 is creditable for 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**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Algorithms</td>
<td>5-I=AKA-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents
Selected topics in algorithmics and theory.

### Intended learning outcomes
The students understand the basic approach of algorithmic computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

### 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 is creditable for 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
--

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

--
Module title: Selected Topics in Embedded Systems
Abbreviation: 10-I=AKES-161-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): --

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

Contents:
Selected topics in embedded systems.

Intended learning outcomes:
The students possess specialised knowledge in the area of embedded systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

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 is creditable for 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): ES.

Referred to in LPO I (examination regulations for teaching-degree programmes):
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in HCI</td>
<td>10-I=AKHCI-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

Selected topics in HCI.

### Intended learning outcomes

The students understand the basic approach of human-computer interaction. They are able to understand the solutions to complex problems in this area and to transfer them to related questions.

### 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 is creditable for bonus)

- written examination (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

**Selected Topics in Computer Science**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>10-I=AKII-182-m01</th>
</tr>
</thead>
</table>

---

## 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)

--

---

## Duration

1 semester

## Module level

graduate

## Other prerequisites

--

---

## Contents

Selected topics in computer science.

---

## Intended learning outcomes

The students are able to understand the solutions to complex problems in computer science and to transfer them to related questions.

---

## Courses

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

--

---

## Additional information

--

---

## Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
---|---
Selected Topics in Intelligent Systems | 10-I=AKIS-161-m01

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

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

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

Contents
Selected topics in intelligent systems.

Intended learning outcomes
The students possess an advanced knowledge in the area of intelligent systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

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 is creditable for 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): IS.

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Selected Topics in Internet Technologies

Module title
Selected Topics in Internet Technologies

Abbreviation
10-I=AKIT-161-m01

Module coordinator
holder of the Chair of Computer Science III

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
graduate

Other prerequisites
--

Contents
Selected topics in computer communication, for example design aspects of future internet structures: setup and control structures of the internet, multicast protocols, protocols for multimedia communication, optical networks, control mechanisms for redundant and real-time communication networks, p2p networks, ad-hoc networks, or -- new concepts and technologies in mobile communication: digital modulation, signal propagation, channel coding, modern transmission technologies (adaptive modulation and coding, hybrid ARQ, OFDM, MIMO), mac layer, mobileIP, routing in ad-hoc networks, vertical handover, UMTS IP multimedia subsystem, or -- planning and management methods in telecommunication networks: planning methods (forward engineering, reverse engineering), network management paradigms (central and decentral), framework for network management (IETF traffic engineering, ITU-T TMN, OSI management), planning and management methods (IP management mechanisms, network design, measurement, acquisition and evaluation of traffic and performance data, visualisation, result handling, simulation and analysis of networks), management tools, outlook and perspectives, or -- other current topics.

Intended learning outcomes
The students have a knowledge of advanced and current topics in the management and design of modern wired and wireless communication 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 is creditable for 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): IT.

Referred to in LPO I
(examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th><strong>Module title</strong></th>
<th><strong>Abbreviation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in IT Security</td>
<td>10-I=AKITS-172-m01</td>
</tr>
</tbody>
</table>

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

**Module offered by**
Institute of Computer Science

<table>
<thead>
<tr>
<th><strong>ECTS</strong></th>
<th><strong>Method of grading</strong></th>
<th><strong>Duration</strong></th>
<th><strong>Module level</strong></th>
<th><strong>Other prerequisites</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>numerical grade</td>
<td>1 semester</td>
<td>graduate</td>
<td>--</td>
</tr>
</tbody>
</table>

**Contents**
Selected topics in IT security.

**Intended learning outcomes**
The students possess an advanced knowledge in the area of IT security. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

**Courses** (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)
Module taught in: English

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

**Allocation of places**
--

**Additional information**
Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): SE, JS, LR, HCI, ES.

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
Selected Topics in Aerospace Engineering

Module title: Selected Topics in Aerospace Engineering
Abbreviation: 10-I=AKLR-161-m01

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

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

Contents:
Selected topics in aerospace engineering, for example: satellite communication, rocket science, propulsion systems, sensors and actuators for orientation control, perturbation of orbits, interplanetary orbits, rendezvous and docking, design of space ships, design of planetary bases, life support systems, special aspects of operations, payloads, optical systems, RADAR, earth monitoring, thermo management, structure of space ships, special areas of navigation, space environment, environment simulation, verification and test of space faring systems, space astronomy and planet missions, space medicine and biology, material science, quality management, space law, aeroflight topics, avionics for airplanes, air traffic control, areal navigation, pilot interfaces, air traffic control, air traffic management.

Intended learning outcomes:
The students possess an advanced knowledge about the respective topic of the selected area and are able to consider these foundations in their future plans of air or spaceborne systems.

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).
Separate written examination for Master's students.
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): LR.
Referred to in LPO I (examination regulations for teaching-degree programmes): --
Module title: Selected Topics in Theory

Abbreviation: 10-I-AKT-161-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

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

Duration: 1 semester

Module level: graduate

Other prerequisites: --

Contents:

Selected topics in algorithmics and theory.

Intended learning outcomes:

The students understand the basic approach of theoretical computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

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 is creditable for 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:

--

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

--
Module title | Abbreviation
--- | ---
Selected Topics of Games Engineering | 10-I=AGE-191-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science I | Institute of Computer Science

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

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

Contents
Selected topics in algorithmics and theory.

Intended learning outcomes
The students understand the basic approach of games engineering. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

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 is creditable for 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): GE.

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Software Engineering</td>
<td>10-I=AKSE-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in software engineering.

**Intended learning outcomes**

The students possess an advanced knowledge about selected aspects of software engineering.

**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 is creditable for 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): SE.

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

--
Module title: Performance Evaluation of Distributed Systems

Abbreviation: 10-I=LVS-161-m01

Module coordinator: holder of the Chair of Computer Science III

Module offered by: Institute of Computer Science

ECTS: 8

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

Numerical grade: --

Duration: 1 semester

Module level: graduate

Other prerequisites: --

Contents:
Traffic theoretic models, fundamental concepts of theory of probability, transformation techniques, stochastic processes, methods for performance analysis of technical systems, queue-/traffic theory, analysis of Markov, non-Markov and time critical systems, matrix analytical method, practical examples for performance analysis of computer systems and networks: throughput and goodput analysis and other characteristics.

Intended learning outcomes:
The students possess the methodic knowledge and the practical skills necessary to model technical systems by means of the theory of probability and mathematical statistics.

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

Allocation of places:
--

Additional information:
--

Referred to in LPO I (examination regulations for teaching-degree programmes):
--
Module title: Machine learning for Natural Language Processing

Abbreviation: 10-I=NLP-182-m01

Module coordinator: Dean of Studies Informatik (Computer Science)

Module offered by: Institute of Computer Science

ECTS: 5

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

Duration: 1 semester

Module level: graduate

Other prerequisites: --

Contents:
The lecture conveys advanced knowledge about methods in computational text processing. To this end, it presents state of the art models and techniques in the area of machine learning, as well as their technical background, and their respective applications in Natural Language Processing. As one important building block of almost all modern NLP-models, different techniques for learning representations of words, so called Word Embeddings, are presented. Starting from this we cover, among others, models from the area of Deep Learning, like CNNs, RNNs and Sequence-to-Sequence architectures. The theoretical foundations of these models, like their training with Backpropagation, are also covered in depth. For all models presented in the lecture, we show their application to problems like sentiment analysis, text generation and machine translation in practice.

Intended learning outcomes:
The participants have solid knowledge on problems and methods in the area of computational text processing and are able to identify and apply suitable methods for a specific task.

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:
--

Additional information:
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, IS, HCI.

Referred to in LPO I (examination regulations for teaching-degree programmes):
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Engineering and Benchmarking</td>
<td>10-I=PEB-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Introduction to performance engineering of commercial software systems, performance measurement techniques, benchmarking of commercial software systems, modelling for performance prediction, case studies.

**Intended learning outcomes**

The students possess a fundamental and applicable knowledge in the areas of performance metrics, measurement techniques, multi-factorial variance analysis, data analysis with R, benchmark approaches, modelling with queue networks, modelling methods, resource demand approximation, petri nets.

**Courses**

<table>
<thead>
<tr>
<th>(type, number of weekly contact hours, language — if other than German)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V (2) + Ü (2)</td>
</tr>
</tbody>
</table>

Module taught in: English

**Method of assessment**

<table>
<thead>
<tr>
<th>(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>written examination (approx. 90 to 120 minutes)</td>
</tr>
</tbody>
</table>

Language of assessment: English

creditable for bonus

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical course - Current Topics in Computer Science</td>
<td>10-I=PRAK-161-m01</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>(not) successfully completed</td>
<td>--</td>
</tr>
</tbody>
</table>

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

**Contents**

Completion of a practical task.

**Intended learning outcomes**

The practical allows participants to work on a problem in computer science in 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 is creditable for bonus)**

term paper (5 to 15 pages)
Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

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

--
Module title | Seminar 1 - Current Topics in Computer Science
--- | ---
Abbreviation | 10-I=SEM3-161-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) | --

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

Contents
Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

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 is creditable for bonus)
term paper (10 to 15 pages) and presentation (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
--

Additional information
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
### Seminar 2 - Current Topics in Computer Science

**Abbreviation**: 10-I=SEM4-161-m01

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar 2 - Current Topics in Computer Science</td>
<td>10-I=SEM4-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

**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 is creditable for bonus)

Term paper (10 to 15 pages) and presentation (30 to 45 minutes) with subsequent discussion on the topic of the seminar.

Language of assessment: German and/or English.

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI.

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

--
Module title | Security of Software Systems | Abbreviation | 10-I=SSS-172-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science II | Institute of Computer Science

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

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

Contents
The lecture provides an overview of common software vulnerabilities, state-of-the-art attack techniques on modern computer systems, as well as the measures implemented to protect against these attacks. In the course, the following topics are discussed:

- x86-64 instruction set architecture and assembly language
- Runtime attacks (code injection, code reuse, defenses)
- Web security
- Blockchains and smart contracts
- Side-channel attacks
- Hardware security

Intended learning outcomes
Students gain a deep understanding of software security, from hardware and low-level attacks to modern concepts such as blockchains. The lecture prepares for research in the area of security and privacy, while the exercises allow students to gain hands-on experience with attacks and analysis of systems from an attacker’s perspective.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)
Module taught in: English

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

Allocation of places
--

Additional information
Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): SE, IS, LR, HCI, ES.
Basic programming knowledge in C is required.

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module title: Discrete Event Simulation
Abbreviation: 10-I=ST-161-m01

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

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

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

Contents:
Introduction to simulation techniques, statistical groundwork, creation of random numbers and random variables, random sample theory and estimation techniques, statistical analysis of simulation values, inspection of measured data, planning and evaluation of simulation experiments, special random processes, possibilities and limits of model creation and simulation, advanced concepts and techniques, practical execution of simulation projects.

Intended learning outcomes:
The students possess the methodic knowledge and the practical skills necessary for the stochastic simulation of (technical) systems, the evaluation of results and the correct assessment of the possibilities and limits of simulation methods.

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 is creditable for 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: --

Referred to in LPO I (examination regulations for teaching-degree programmes): --
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Architecture</td>
<td>10-I=SAR-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents
Current topics in the area of aerospace.

### Intended learning outcomes
The students possess a fundamental and applicable knowledge about advanced topics in software engineering with a focus on modern software architectures and fundamental approaches to model-driven software engineering.

### 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 is creditable for 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
--

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

--
Winter Term 2021
(0 ECTS credits)
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Point Cloud Processing</td>
<td>10-I=3D-212-m01</td>
</tr>
</tbody>
</table>

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

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

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

**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)

Module taught in: English

**Method of assessment**

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

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

Separate written examination for Master’s students. creditable for bonus

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): KI,L-R,HCI,GE

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Automation</td>
<td>10-I=AA-152-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Advanced topics in automation systems as well as instrumentation and control engineering, for example from the field of sensor data processing, actuators, cooperating systems, mission and trajectory planning.

**Intended learning outcomes**

The students have an advanced knowledge of selected topics in automation systems. They are able to implement advanced automation 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 is creditable for bonus)

written examination (approx. 60 to 120 minutes)
creditable for bonus

**Allocation of places**

--

**Additional information**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computational Geometry</td>
<td>10-I-AG-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

In many areas of computer science -- for example robotics, computer graphics, virtual reality and geographic information systems -- it is necessary to store, analyse, create or manipulate spatial data. This class is about the algorithmic aspects of these tasks: We will acquire techniques that are needed to plan and analyse geometric algorithms and data structures. Every technique will be illustrated with a problem in the practical areas listed above.

### Intended learning outcomes

The students are able to decide which algorithms or data structures are suitable for the solution of a given geometric problem. The students are able to analyse new problems and to come up with their own efficient solutions based on the concepts and techniques acquired in the lecture.

### 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 is creditable for 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

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
### Module title
Approximation Algorithms

### Abbreviation
10-I=APA-161-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

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

### Duration
1 semester

### Module level
graduate

### Other prerequisites
--

### Contents
The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming.

### Intended learning outcomes
The students are able to analyse easy approximation methods in terms of their quality. They understand fundamental drafting techniques such as greedy, local search and scaling as well as methods based on linear programming and are able to apply these to new problems.

### 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 is creditable for 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
--

### Referred to in LPO I
(examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Algorithms</td>
<td>10-I=AKA-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

Selected topics in algorithmics and theory.

### Intended learning outcomes

The students understand the basic approach of algorithmic computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

### 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 is creditable for 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

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Selected Topics in Embedded Systems  

Module title: Selected Topics in Embedded Systems  
Abbreviation: 10-I=AKES-161-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): --  
Duration: 1 semester  
Module level: graduate  
Other prerequisites: --  

Contents  
Selected topics in embedded systems.  

Intended learning outcomes  
The students possess specialised knowledge in the area of embedded systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.  

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 is creditable for 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): ES.  

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

### Abbreviation
10-I=AKHCI-182-m01

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

### 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
graduate

### Other prerequisites
--

### Contents
Selected topics in HCI.

### Intended learning outcomes
The students understand the basic approach of human-computer interaction. They are able to understand the solutions to complex problems in this area and to transfer them to related questions.

### 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 is creditable for bonus)

written examination (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)

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Computer Science</td>
<td>10-I=AKII-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in computer science.

**Intended learning outcomes**

The students are able to understand the solutions to complex problems in computer science and to transfer them to related questions.

**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 is creditable for 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**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
Module title
Selected Topics in Intelligent Systems

Abbreviation
10-I=AKIS-212-m01

Module coordinator
holder of the Chair of Computer Science IX

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
graduate

Other prerequisites
--

Contents
Selected topics in intelligent systems.

Intended learning outcomes
The students possess an advanced knowledge in the area of intelligent systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

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

Allocation of places
--

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

KI

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

--
Module title: Selected Topics in Internet Technologies

Abbreviation: 10-I=AKIT-161-m01

Module coordinator: holder of the Chair of Computer Science III

Module offered by: Institute of Computer Science

ECTS: 5

Method of grading: numerical grade

Duration: 1 semester

Module level: graduate

Other prerequisites: --

Contents:
Selected topics in computer communication, for example design aspects of future internet structures: setup and control structures of the internet, multicast protocols, protocols for multimedia communication, optical networks, control mechanisms for redundant and real-time communication networks, p2p networks, ad-hoc networks, or -- new concepts and technologies in mobile communication: digital modulation, signal propagation, channel coding, modern transmission technologies (adaptive modulation and coding, hybrid ARQ, OFDM, MIMO), mac layer, mobileIP, routing in ad-hoc networks, vertical handover, UMTS IP multimedia subsystem, or -- planning and management methods in telecommunication networks: planning methods (forward engineering, reverse engineering), network management paradigms (central and decentral), framework for network management (IETF traffic engineering, ITU-T TMN, OSI management), planning and management methods (IP management mechanisms, network design, measurement, acquisition and evaluation of traffic and performance data, visualisation, result handling, simulation and analysis of networks), management tools, outlook and perspectives, or -- other current topics.

Intended learning outcomes:
The students have a knowledge of advanced and current topics in the management and design of modern wired and wireless communication 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 is creditable for 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): IT.

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in IT Security</td>
<td>10-I=AKITS-212-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in IT security.

**Intended learning outcomes**

The students possess an advanced knowledge in the area of IT security. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

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

- V (2) + Ü (2)

Module taught in: English

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

- 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
- Language of assessment: English

**Allocation of places**

--

**Additional information**

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

- SE, KI, LR, HCI, ES, SEC

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Aerospace Engineering</td>
<td>10-I=AKLR-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in aerospace engineering, for example: satellite communication, rocket science, propulsion systems, sensors and actuators for orientation control, perturbation of orbits, interplanetary orbits, rendezvous and docking, design of space ships, design of planetary bases, life support systems, special aspects of operations, payloads, optical systems, RADAR, earth monitoring, thermo management, structure of space ships, special areas of navigation, space environment, environment simulation, verification and test of space faring systems, space astronomy and planet missions, space medicine and biology, material science, quality management, space law, aeroflight topics, avionics for airplanes, air traffic control, areal navigation, pilot interfaces, air traffic control, air traffic management.

**Intended learning outcomes**

The students possess an advanced knowledge about the respective topic of the selected area and are able to consider these foundations in their future plans of air or spaceborne 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 is creditable for 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).

Separate written examination for Master’s students.

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): LR.

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

--
<table>
<thead>
<tr>
<th><strong>Module title</strong></th>
<th><strong>Abbreviation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics in Theory</td>
<td>10-I=AKT-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Selected topics in algorithmics and theory.

**Intended learning outcomes**

The students understand the basic approach of theoretical computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

**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 is creditable for 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**

--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Topics of Games Engineering</td>
<td>10-I=AGE-191-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

Selected topics in algorithmics and theory.

### Intended learning outcomes

The students understand the basic approach of games engineering. They are able to understand the solutions of complex problems in this area and apply them to similar questions.

### Courses

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Weekly Contact Hours</th>
<th>Language</th>
<th>Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ü</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Method of assessment

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

written examination (approx. 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): GE.

### Referred to in LPO I

(examination regulations for teaching-degree programmes)
Module title: Selected Topics in Software Engineering
Abbreviation: 10-I=AKSE-161-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: graduate
Other prerequisites: --

Contents:
Selected topics in software engineering.

Intended learning outcomes:
The students possess an advanced knowledge about selected aspects of software engineering.

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

Allocation of places:
--

Additional information:
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE.

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

--
Module title | Abbreviation
---|---
Performance Evaluation of Distributed Systems | 10-I=LVS-161-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science III | Institute of Computer Science

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

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

Contents
Traffic theoretic models, fundamental concepts of theory of probability, transformation techniques, stochastic processes, methods for performance analysis of technical systems, queue-/traffic theory, analysis of Markov, non-Markov and time critical systems, matrix analytical method, practical examples for performance analysis of computer systems and networks: throughput and goodput analysis and other characteristics.

Intended learning outcomes
The students possess the methodic knowledge and the practical skills necessary to model technical systems by means of the theory of probability and mathematical statistics.

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 is creditable for 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  
 créditable for bonus

Allocation of places
--

Additional information
--

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine learning for Natural Language Processing</td>
<td>10-I=NLP-212-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**
The lecture conveys advanced knowledge about methods in computational text processing. To this end, it presents state of the art models and techniques in the area of machine learning, as well as their technical background, and their respective applications in Natural Language Processing. As one important building block of almost all modern NLP-models, different techniques for learning representations of words, so called Word Embeddings, are presented. Starting from this we cover, among others, models from the area of Deep Learning, like CNNs, RNNs and Sequence-to-Sequence architectures. The theoretical foundations of these models, like their training with Backpropagation, are also covered in depth. For all models presented in the lecture, we show their application to problems like sentiment analysis, text generation and machine translation in practice.

**Intended learning outcomes**
The participants have solid knowledge on problems and methods in the area of computational text processing and are able to identify and apply suitable methods for a specific 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 is creditable for 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
- Language of assessment: German and/or English

**Allocation of places**
--

**Additional information**
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits):
AT,KI,HCI

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Engineering and Benchmarking</td>
<td>10-I=PEB-182-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**
Introduction to performance engineering of commercial software systems, performance measurement techniques, benchmarking of commercial software systems, modelling for performance prediction, case studies.

**Intended learning outcomes**
The students possess a fundamental and applicable knowledge in the areas of performance metrics, measurement techniques, multi-factorial variance analysis, data analysis with R, benchmark approaches, modelling with queue networks, modelling methods, resource demand approximation, petri nets.

**Courses**
V (2) + Ü (2)
Module taught in: English

**Method of assessment**
written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

**Allocation of places**
--

**Additional information**
--

**Referred to in LPO I**
(examination regulations for teaching-degree programmes)
--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical Course - Current Topics in Computer Science</td>
<td>10-I=PRAK-212-m01</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>(not) successfully completed</td>
<td>--</td>
</tr>
</tbody>
</table>

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

### Contents
Completion of a practical task.

### Intended learning outcomes
The practical allows participants to work on a problem in computer science in teams.

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of weekly contact hours</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>6</td>
<td>German and English</td>
</tr>
</tbody>
</table>

The course is offered in parallel in both German and English.

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Scope</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>term paper</td>
<td>5 to 15 pages</td>
<td>German and/or English</td>
</tr>
</tbody>
</table>

### Allocation of places
--

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

- AT
- SE
- IT
- KI
- ES
- IR
- HCI
- GE

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar 1 - Current Topics in Computer Science</td>
<td>10-I=SEM3-212-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

**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)

Module taught in: German and English

The course is offered in parallel in both German and English.

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

Term paper (10 to 15 pages) and presentation (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**

--

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, KI, ES, LR, HCI, GE

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar 2 - Current Topics in Computer Science</td>
<td>10-I=SEM4-212-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.

**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)

<table>
<thead>
<tr>
<th>S (2)</th>
<th>Module taught in: German and English</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The course is offered in parallel in both German and English.</td>
</tr>
</tbody>
</table>

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

| term paper (10 to 15 pages) and presentation (30 to 45 minutes) with subsequent discussion on the topic of the seminar |
| Langu age of assessment: German and/or English |

**Allocation of places**

--

**Additional information**

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, KI, ES, LR, HCI, GE

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security of Software Systems</td>
<td>10-I=SSS-212-m01</td>
</tr>
</tbody>
</table>

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

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

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

### Contents

The lecture provides an overview of common software vulnerabilities, state-of-the-art attack techniques on modern computer systems, as well as the measures implemented to protect against these attacks. In the course, the following topics are discussed:

- x86-64 instruction set architecture and assembly language
- Runtime attacks (code injection, code reuse, defenses)
- Web security
- Blockchains and smart contracts
- Side-channel attacks
- Hardware security

### Intended learning outcomes

Students gain a deep understanding of software security, from hardware and low-level attacks to modern concepts such as blockchains. The lecture prepares for research in the area of security and privacy, while the exercises allow students to gain hands-on experience with attacks and analysis of systems from an attacker’s perspective.

### Courses

(V (2) + Ü (2))

Module taught in: English

### 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: English

### Allocation of places

--

### Additional information

Focuses available for students of the Master’s programme Informatik (Computer Science, 120 ECTS credits):
- SE, KI, LR, HCI, ES, SEC

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discrete Event Simulation</td>
<td>10-I=ST-212-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Introduction to simulation techniques, statistical groundwork, creation of random numbers and random variables, random sample theory and estimation techniques, statistical analysis of simulation values, inspection of measured data, planning and evaluation of simulation experiments, special random processes, possibilities and limits of model creation and simulation, advanced concepts and techniques, practical execution of simulation projects.

**Intended learning outcomes**

The students possess the methodic knowledge and the practical skills necessary for the stochastic simulation of (technical) systems, the evaluation of results and the correct assessment of the possibilities and limits of simulation methods.

**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 is creditable for 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**

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

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

--
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Architecture</td>
<td>10-I=SAR-161-m01</td>
</tr>
</tbody>
</table>

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

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

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

**Contents**

Current topics in the area of aerospace.

**Intended learning outcomes**

The students possess a fundamental and applicable knowledge about advanced topics in software engineering with a focus on modern software architectures and fundamental approaches to model-driven software engineering.

**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 is creditable for 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**

--

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

--